SECTION 00001

PROJECT TITLE PAGE

999 BRADY AVENUE MIXED-USE CENTER

999 BRADY AVENUE

ATLANTA, GA 30318

24 DECEMBER 2008

ARCHITECT: PLEXUS R+D, INC.

914 HOWELL MILL ROAD, SUITE 300

ATLANTA, GA 30318

404-519-7728

STRUCTURAL ENGINEER: STABILITY ENGINEERING, INC.

431 WEST PONCE DE LEON AVENUE, SUITE 4

DECATUR, GA 30030

404-377-9316

MEP & FP ENGINEERING: BARRETT, WOODYARD & ASSOCIATES

3495 HOLCOMB BRIDGE ROAD

NORCROSS, GA 30092

770-810-8800

CIVIL ENGINEER: EBERLY & ASSOCIATES

1852 CENTURY PLACE, SUITE 202

ATLANTA, GA 30345

770-452-7849

END OF PROJECT TITLE PAGE

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SECTION 01100

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: 999 brady Avenue Mixed-use Center.

B. Owner's Name: Cartel Properties.

C. Architect's Name: plexus r+d, Inc..

D. The Project consists of the alteration of an existing 36,970 square foot single storey masonry and structural steel frame building, to be converted into a combination of mercantile space and a new performing arts thetare.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00500 - Agreement.

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is shown on drawings.

B. Scope of alterations work is shown on drawings.

C. Plumbing: Replace existing system with new construction.

D. Electrical Power and Lighting: Replace existing system with new construction.

E. Fire Suppression Sprinklers: Alter existing and add new construction.

F. Telephone: Replace existing system with new construction.

1.04 CONTRACTOR USE OF SITE AND PREMISES

A. Provide access to and from site as required by law and by Cartel Properties:
   1. Do not obstruct roadways, sidewalks, or other public ways without permit.

END OF SECTION

SECTION 01200

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Price and Contract Time.

1.02 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to plexus r+d, Inc. for approval.

C. For each item, provide a column for listing each of the following:
   1. Item Number.
   2. Description of work.
   3. Scheduled Values.
   4. Previous Applications.
   5. Work in Place and Stored Materials under this Application.
   6. Authorized Change Orders.
   7. Total Completed and Stored to Date of Application.
   8. Percentage of Completion.
   9. Balance to Finish.
   10. Retainage.

D. Execute certification by signature of authorized officer.

E. Submit three copies of each Application for Payment.

1.03 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Price or Contract Time, plexus r+d, Inc. will issue instructions directly to Contractor.

B. For other required changes, plexus r+d, Inc. will issue a document signed by Cartel Properties instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Price or Contract Time.
   2. Promptly execute the change.

C. For changes for which advance pricing is desired, plexus r+d, Inc. will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.

D. Contractor may propose a change by submitting a request for change to plexus r+d, Inc., describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01600.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.

1. For change requested by plexus r+d, Inc. for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by plexus r+d, Inc..

END OF SECTION

SECTION 01600

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Substitution limitations and procedures.

1.02 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

D. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Cartel Properties.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

E. Substitution Submittal Procedure:

1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. The plexus r+d, Inc. will notify Contractor in writing of decision to accept or reject request.

3.02 TRANSPORTATION AND HANDLING

A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

B. Transport and handle products in accordance with manufacturer's instructions.

C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Prevent contact with material that may cause corrosion, discoloration, or staining.

H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 03100

CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Form accessories.

C. Form stripping.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute; 2006.

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute; 2005.

C. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute; 2004.

D. PS 1 - Structural Plywood; 2007.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.

2.02 WOOD FORM MATERIALS

A. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.

2.03 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch (25 mm) in concrete surface.

B. Form Release Agent: Colorless mineral oil that will not stain concrete.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

D. Install formwork to acheive joints indicated in drawings.

3.03 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

3.04 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

END OF SECTION

SECTION 05400

COLD FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall and interior wall framing.

B. Exterior wall sheathing.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Wood blocking and miscellaneous framing.

B. Section 07212 - Board and Batt Insulation: Insulation within framing members.

C. Section 07260 - Weather Barriers: Weather barrier over sheathing.

D. Section 09220 - Portland Cement Plaster.

1.03 REFERENCE STANDARDS

A. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

B. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2007.

C. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2006.

1.04 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.02 FRAMING MATERIALS

A. Studs and Track: ASTM C 955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gage and depth: As indicated on the drawings.

2.03 WALL SHEATHING

A. Wall Sheathing: Glass mat faced gypsum; ASTM C 1177/C 1177M, square long edges, 1/2 inch (12.5 mm).

2.04 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A 153/A 153M.

B. Anchorage Devices: Power actuated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C 1007 requirements.

3.03 WALL SHEATHING

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.

END OF SECTION

SECTION 07195

AIR INFILTRATION BARRIER / SECONDARY WEATHER RESISTIVE MEMBRANE

GENERAL

1.01 SUMMARY

1.02 INCLUDES BUT NOT LIMITED TO:

A. Furnish and install over exterior of wall sheathing at all locations excluding those with E.I.F.S., regardless of whether or not indicated on drawings to protect exterior sheathing and interior walls.

B. REFERENCES

C. AATCC - 127

D. TAPPI T - 460 (sec/100cc)

E. ASTME 96 (g/m2 -24 hr.)

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the conditions of the Contract and Division 1 Specifications Sections.

B. Product Data: Submit product specifications, technical data and installation instructions of manufacturer equaling or exceeding those specified.

1.04 PRODUCTS

1.05 Air infiltration barrier/secondary weather resistive membrane:

A. Spunbonded olefin, None-woven, Non-perforated.

B. Performance Requirements:
   1. Water penetration resistance of 210 cm in accordance with AATCC - 127.
   2. Air infiltration at 300 seconds in accordance with TAPPI T - 460 (sec/100cc).
   3. Water vapor transmission of 58 perms in accordance with ASTM E 96 Method B(g/m2 - 24 hr.).
   4. Basis weight of 2.5oz/yd in accordance with TAPPIT- 410.
   5. Membrane shall be free from holes and breaks other than those created by fasteners and construction system due to attachment.
   6. Approved Manufacturer:
      a. DuPont Tyvek® HomeWrap® by DuPont Company, Wilmington, Delaware.
      b. SEALING TAPE / FASTENERS:

C. Approved Tape Manufacturers.
   1. DuPont Contractor Tape, by DuPont Company, Wilmington Delaware.
   2. Recommended fasteners for wood framed construction:
      a. Nails with large heads or plastic washers.
   3. Recommended fasteners for steel framed construction:
      a. Rust resistant screws with washers
   4. Recommended fastening to masonry:
      a. Polyurethane or elastomeric adhesives.

1.06 EXECUTION

1.07 AIR INFILTRATION BARRIER

A. Install air infiltration barrier over exterior side of exterior wall sheathing.

1. Install air infiltration barrier after sheathing is installed and before windows and doors are installed. Install lower level barrier prior to upper layers to ensure proper shingling of layers.
2. Overlap air infiltration barrier at corners of building by a minimum of 12 inches.
3. Overlap air infiltration barrier vertical seams by a minimum of 6 inches.
4. Ensure barrier is plum and level with foundation, and unroll extending air infiltration barrier over window and door openings.
5. Attach air infiltration barrier to wood, insulated sheathing board or exterior gypsum with plastic cap nails every 12” to 18” on vertical stud line with wood stud framing, and screws with washers to metal stud framing.
6. Prepare window and door rough openings as follows:
   a. Horizontally cut air infiltration barrier along bottom of header.
   b. Vertically cut air infiltration barrier down the center of window openings from the top of the window opening down to 2/3 of the way to the bottom of the window openings.
   c. Diagonally cut air infiltration barrier from the bottom of the vertical cut to the left and right corners of opening.
   d. Fold side and bottom flaps into window opening and fasten every 6 inches. Trim off excess.
7. Prepare each rough door opening by cutting a standard “I” pattern in the air infiltration barrier. This is done as follows:
   a. Horizontally cut air infiltration barrier along bottom of door frame header and along top of sill.
   b. Vertically cut air infiltration barrier down the center of door openings from the top of the door opening (header) down to the bottom of the door opening (sill).
   c. Fold side flaps inside around door openings and fasten every 6 inches. Trim off excess.
8. Tape all horizontal and vertical seams of air infiltration barrier.
9. Tape a patch over all tears and cuts in air infiltration barrier.

END OF SECTION

SECTION 07212

BOARD AND BATT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Batt insulation in exterior wall, ceiling, and roof construction.

1.02 RELATED REQUIREMENTS

A. Section 05400 - Cold Formed Metal Framing: Supporting construction for batt insulation.

B. Section 07260 - Weather Barriers: Separate air barrier and vapor retarder materials.

C. Section 09260 - Gypsum Board Assemblies: Acoustic insulation.

1.03 REFERENCE STANDARDS

A. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.

B. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2004.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

2.02 BATT INSULATION MATERIALS

A. Batt Insulation: ASTM C 665; preformed batt; friction fit, conforming to the following:
   1. Combustibility: Non-combustible, when tested in accordance with ASTM E 136, except for facing, if any.
   2. Manufacturers:
      a. CertainTeed Corporation: www.certainteed.com.
      b. Johns Manville Corporation: www.jm.com.
      c. Owens Corning Corp: www.owenscorning.com.
   3. Substitutions: See Section 01600 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.02 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. At metal framing, place vapor retarder on warm side of insulation; lap and seal sheet retarder joints over member face.

F. Tape seal tears or cuts in vapor retarder.

G. Extend vapor retarder tightly to full perimeter of adjacent window and door frames and other items interrupting the plane of the membrane. Tape seal in place.

END OF SECTION

SECTION 08411

ALUMINUM STOREFRONTS (SERIES 3000 FLUSH GLAZE)

PART 1 - GENERAL

1.01 SUMMARY

A. Related Documents: Conditions of the Contract, Division 1 - General Requirements, and Drawings apply to Work of this Section.

B. Section Includes:
   1. Storefront system, complete with reinforcing, fasteners, anchors, and attachment devices.
   2. Accessories necessary to complete work.

C. Products Furnished But Not Installed Under This Section:
   1. Anchoring devices that are built into masonry.
   2. Anchoring devices that are cast in concrete.

D. Related Sections:
   1. Section 07900 - Joint Sealers.
   2. Section 08810 - Glass and Glazing.

1.02 REFERENCES

A. Aluminum Association (AA):
   1. DAF-45 Designation System for Aluminum Finishes.

B. American Society for Testing and Materials (ASTM):
   1. B221 Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
   2. E331 Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

C. Glass Association of North America (GANA):
   1. Glazing Manual

1.03 SYSTEM REQUIREMENTS

A. Design Requirements:
   1. Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage, or moisture disposal.
   2. Requirements shown by details are intended to establish basic dimension of units, sight lines and profiles of members.
   3. Provide concealed fastening.
   4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
   5. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
   6. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
   7. Provide for expansion and contraction due to structural movement without detriment to appearance or performance.
   8. Framing systems shall accommodate expansion and contraction movement due to surface temperature differentials of 180 degrees F without causing buckling, stress on glass, failure of joint seals, excessive stress on structural elements, reduction of performance, or other detrimental effects.

B. Performance Requirements:

1. Wind loads: Provide framing system capable of withstanding wind load design pressures as established in applicable building codes. The design pressures are based on the International Building Code; 2006 Edition.
2. Air infiltration: Air leakage through fixed light areas of storefront shall not exceed 0.06 cfm per square foot of surface area when tested in accordance with ASTM E283 at differential static pressure of 6.24 psf.
3. Water infiltration: No uncontrolled leakage when tested in accordance with ASTM E331 at test pressure of 10 psf as defined in AAMA 501.
4. Deflection:
   a. Maximum calculated deflection of any framing member in direction normal to plane of wall when subjected to specified design pressures for spans up to and including 13'-6" shall be limited to [1/175] of its clear span and for spans greater than 13'-6" deflection shall be limited to [1/240] of its clear span + 1/4", except that maximum deflection of members supporting plaster surfaces shall not exceed 1/360 of its span.

C. Testing Requirements: Provide components that have been previously tested by an independent testing laboratory.

1.04 SUBMITTALS

A. General: Submit in accordance with Section 01300.

B. Product Data:
1. Submit manufacturer's descriptive literature and product specifications.
2. Include information for factory finishes, hardware, accessories, and other required components.
3. Include color charts for finish indicating manufacturer's standard colors available for selection.]

C. Shop Drawings:
1. Submit shop drawings covering fabrication, installation and finish of specified systems.
2. Include following:
   a. Fully dimensioned plans and elevations with detail coordination keys.
   b. Locations of exposed fasteners and joints.
3. Provide detailed drawings of:
   a. Composite members.
   b. Joint connections for framing systems and for entrance doors.
   c. Anchorage.
   d. System reinforcements.
   e. System expansion and contraction provisions.
   f. Glazing methods and accessories.
   g. Internal sealant requirements.
4. Schedule of finishes.

D. Samples:
1. Submit manufacturers standard samples indicating quality of finish.
2. Where normal texture or color variations are expected, include additional samples illustrating range of variation.
3. Submit samples for each type of glass, 12 x 12 inch size.]

E. Test Reports:
1. Standard Systems: Submit certified copies of previous test reports substantiating performance of system in lieu of retesting. Include other supportive data as necessary.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility:

1. To ensure quality of appearance and performance, obtain materials for systems from either a single manufacturer or from manufacturer approved by systems manufacturer.

B. Perform Work in accordance with AAMA SFM-1 and manufacturer's written instructions.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01600.

B. Protect finished surfaces as necessary to prevent damage.

C. Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sun.

D. Do not leave coating residue on any surfaces.

E. Replace damaged units.

1.07 WARRANTY

A. Provide warranties in accordance with Section 01700.

B. Provide written warranty in form acceptable to Owner jointly signed by manufacturer, installer and Contractor warranting work to be watertight, free from deflective materials, defective workmanship, glass breakage due to defective design, and agreeing to replace components which fail within 1 year from date of Substantial Completion.

C. Warranty shall cover following:
1. Complete watertight and airtight system installation within specified tolerances.
2. System is structurally sound and free from distortion.

D. Provide written warranty stating organic coating finish will be free from fading more than 10%, chalking, yellowing, peeling, cracking, pitting, corroding or non-uniformity of color, or gloss deterioration beyond manufacturer's descriptive standards for 1 year from date of Substantial Completion and agreeing to promptly correct defects.

PART 2 - PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

A. Subject to compliance with requirements indicated, provide products by one of the following:
1. Vistawall Architectural Products, Terrell, TX.

B. Substitutions: Substitutions: See Section 01600 - Product Requirements.

C. Acceptable Storefront Framing System:
1. Flush Glazed System, center set, exterior loaded
2. Series 3000 - 2" x 4-1/2" mullion profile. This system accommodates 1" glass thickness, with 1/4" as an option.

2.02 FRAMING MATERIALS AND ACCESSORIES

A. Aluminum:
1. ASTM B221, alloy 6063-T5 for extrusions; ASTM B209, alloy 5005-H16 for sheets; or other alloys and temper recommended by manufacturer appropriate for specified finish.

B. Internal Reinforcing:
1. ASTM A36 for carbon steel.
2. Shapes and sizes to suit installation.
3. Steel components factory coated with alkyd type zinc chromate primer complying with FS TT-P-645.

C. Anchorage Devices:
   1. Manufacturer's standard formed or fabricated steel or aluminum assemblies of shapes, plates, bars or tubes.
   2. Hot-dip galvanize steel assemblies after fabrication; comply with ASTM A123, 2.0 ounce minimum coating.

D. Fasteners:
   1. Aluminum, non-magnetic stainless steel or other non-corrosive materials compatible with items being fastened.
   2. Provide concealed fasteners wherever possible.
   3. For exposed locations, provide Phillips flathead screws with finish matching item fastened.
   4. For concealed locations, provide manufacturer's standard fasteners.

E. Expansion Anchor Devices: Lead-shield or toothed-steel, drilled-in, expansion bolt anchors.

F. Protective Coatings: Cold-applied asphalt mastic complying with SSPC, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

G. Touch-Up Primer for Galvanized Components: Zinc oxide conforming with FS TT-P-641.

H. Glazing Gaskets:
   1. Compression type design, replaceable, molded or extruded, of neoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).
   2. Profile and hardness as required to maintain uniform pressure for watertight seal.

I. Weatherstripping:
   1. Wool pile conforming to AAMA 701.2.
   2. Provide EPDM or vinyl-blade gasket weatherstripping in bottom door rail, adjustable for contact with threshold.

J. Internal Sealants and Baffles.

2.03 GLASS AND GLAZING ACCESSORIES

A. Refer to Section 08810.

2.04 FABRICATION

A. Coordination of Fabrication:
   1. Check actual frame or door openings required in construction work by accurate field measurements before fabrication.
   2. Fabricate units to withstand loads that will be applied when system is in place.

B. General

2.05 Conceal fasteners wherever possible.

A. Reinforce work as necessary for performance requirements, and for support to structure.

B. Separate dissimilar metals and aluminum in contact with concrete utilizing protective coating or preformed separators, which will prevent contact and corrosion.

C. Comply with Section 08810 for glazing requirements.

D. Aluminum Framing:
   1. Provide members of size, shape and profile indicated, designed to provide for glazing from [exterior] [interior].
   2. Fabricate frame assemblies with joints straight and tight fitting.
   3. Reinforce internally with structural members as necessary to support design loads.
   4. Maintain accurate relation of planes and angles, with hairline fit of contacting members.
   5. Seal horizontals and direct moisture accumulation to exterior.

6. Provide flashings and other materials used internally or externally that are corrosive resistant, non-staining, non-bleeding and compatible with adjoining materials.
7. Provide manufacturer's extrusions and accessories to accommodate expansion and contraction due to temperature changes without detrimental to appearance or performance.

E. Welding:
1. Comply with recommendations of the American Welding Society.
2. Use recommended electrodes and methods to avoid distortion and discoloration.
3. Grind exposed welds smooth and flush with adjacent surfaces; restore mechanical finish.

F. Flashings: Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oil-canning".

2.06 FINISHES

A. Clear Anodized:
1. Conforming to AA-M12C22A31 and AAMA 611.
2. Architectural Class II, etched, medium matte, clear anodic coating, 0.4 mil minimum thickness.]

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01400.

3.02 INSTALLATION

A. Erection Tolerances:
1. Limit variations from plumb and level:

B. 1/8 inch in 10'-0" vertically.

C. Limit offsets in theoretical end-to-end and edge-to-edge alignment: 1/16 inch from flush surfaces not more than 2 inches apart or out-of-flush by more than 1/4 inch.

D. Install doors and hardware in accordance with manufacturer's printed instructions.

E. Set units plumb, level and true to line, without warp or rack of frame.

F. Anchor securely in place, allowing for required movement, including expansion and contraction.

G. Separate dissimilar materials at contact points, including metal in contact with masonry or concrete surfaces, with bituminous paint or preformed separators to prevent contact and corrosion.

H. Set sill members in bed of sealant. Set other members with internal sealants and baffles to provide weather-tight construction.

I. Coordinate installation of perimeter sealant and backing materials between assemblies and adjacent construction in accordance with requirements of Section 07920.

J. Glazing: Refer to requirements of Section 08810.

3.03 ADJUSTING

A. Test door operating functions. Adjust closing and latching speeds and other hardware in accordance with manufacturer's instructions to ensure smooth operation.

3.04 CLEANING

A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials and other unsightly marks.

B. Clean metal surfaces exercising care to avoid damage.

END OF SECTION

SECTION 08800

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07900 - Joint Sealers: Sealant and back-up material.

B. Section 08410 - Metal-Framed Storefronts.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2004.

C. ASTM C 864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005.

D. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2005.

E. ASTM E 1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2007.

F. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2002.

G. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2004.

H. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 1990.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.

1.07 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide a five (5) year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.

PART 2 PRODUCTS

2.01 EXTERIOR GLAZING ASSEMBLIES

A. Structural Design Criteria: Select type and thickness to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with 2006 Edition of International Building code.
   1. Use the procedure specified in ASTM E 1300 to determine glass type and thickness.
   2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
   3. Thicknesses listed are minimum.

2.02 SEALED INSULATING GLASS MATERIALS

A. Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com.
   2. Guardian Industries Corp: www.guardian.com.
   3. Viracon, Apogee Enterprises, Inc: www.viracon.com.
   4. Substitutions: Refer to Section 01600 - Product Requirements.

B. Insulated Glass Units: Double pane with glass to elastomer edge seal.
   1. Outer pane of clear glass, inner pane of clear glass.
   2. Durability: Certified by an independent testing agency to comply with ASTM E 2190.
   3. Purge interpane space with dry hermetic air.
   4. Total unit thickness of 1 inch (____ mm) minimum.

2.03 GLAZING COMPOUNDS

2.04 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C 864 Option I. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.

B. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C 864 Option I; _____ color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)

A. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.

B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.04 MANUFACTURER'S FIELD SERVICES

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.05 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

END OF SECTION

SECTION 09260

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Gypsum sheathing.

F. Gypsum wallboard.

G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 05400 - Cold Formed Metal Framing: Exterior wind-load-bearing metal stud framing.

B. Section 07212 - Board and Batt Insulation: Acoustic insulation.

C. Section 07260 - Weather Barriers: Water-resistive barrier over sheathing.

1.03 REFERENCE STANDARDS

A. ASTM C 475/C 475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002 (Reapproved 2007).

B. ASTM C 645 - Standard Specification for Nonstructural Steel Framing Members; 2007.

C. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.

D. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2007.

E. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board; 2007.

F. ASTM C 954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2007.

G. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007.

H. ASTM C 1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2005.

I. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2006.

J. ASTM C 1396/C 1396M - Standard Specification for Gypsum Board; 2006a.

K. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2004.

L. ASTM E 413 - Classification for Rating Sound Insulation; 2004.

M. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2007.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C 840 and GA-216.
   1. See PART 3 for finishing requirements.

B. Interior Partitions Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 50-54 calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clark Western Building Systems; Product ____: www.clarkwestern.com.
   2. Dietrich Metal Framing; Product ____: www.dietrichindustries.com.
   3. Marino\Ware; Product ____: www.marinoware.com.
   4. The Steel Network, Inc; Product _____: www.SteelNetwork.com.
   5. Substitutions: See Section 01600 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (240 Pa).
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).

C. Ceiling Hangers: Type and size as specified in ASTM C 754 for spacing required.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum: www.americangypsum.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Georgia-Pacific Gypsum LLC: www.gp.com/gypsum.
   4. Lafarge North America Inc: www.lafargenorthamerica.com.
   5. National Gypsum Company: www.nationalgypsum.com.
   6. PABCO Gypsum: www.pabcogypsum.com.
   7. Temple-Inland Inc: www.templeinland.com.
   8. USG Corporation: www.usg.com.
   9. Substitutions: See Section 01600 - Product Requirements.

B. Wallboard: Paper-faced gypsum wallboard as defined in ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Thickness:
      a. Vertical Surfaces: 5/8 inch (16 mm).
      b. Ceilings: 5/8 inch (16 mm).

C. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
   1. Application: Exterior sheathing, unless otherwise indicated.
   2. Glass-Mat-Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C 1177/C 1177M.
   3. Edges: Square, for vertical application.
   4. Glass-Mat-Faced Products:

a. CertainTeed Corporation; GlasRoc Brand.
b. Georgia-Pacific Gypsum LLC; DensGlass Gold Sheathing.
c. National Gypsum Company; Gold Bond Brand e2XP Extended Exposure Sheathing.
d. Substitutions: See Section 01600 - Product Requirements.

D. Exterior Soffit Board: Exterior gypsum soffit board as defined in ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings and soffits in protected exterior areas, unless otherwise indicated.
2. Regular Type Thickness: 1/2 inch (13 mm).
3. Edges: Tapered.
4. Products:
a. American Gypsum; Exterior Soffit Wallboard.
b. CertainTeed Corporation; ProRoc Brand Exterior Soffit Board.
c. Georgia-Pacific Gypsum LLC; ToughRock Soffit Board.
d. Lafarge North America Inc; Soffitboard.
e. National Gypsum Company; Gold Bond Brand Exterior Soffit Board.
f. Pacific Coast Building Products, Inc; PABCO.
g. Temple-Inland Inc; Exterior Gypsum Soffit Board.
h. USG Corporation; Sheetrock Exterior Gypsum Ceiling Board.
i. Substitutions: See Section 01600 - Product Requirements.

2.04 ACCESSORIES

A. Acoustic Insulation: ASTM C 665; preformed glass fiber, friction fit type, unfaced.

B. Finishing Accessories: ASTM C 1047, galvanized steel or rolled zinc, unless otherwise indicated.
1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.

C. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.

D. Screws for Attachment to Steel Members Less Than 0.03 inch (0.7 mm) In Thickness, to Wood Members, and to Gypsum Board: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.

E. Screws for Attachment to Steel Members From 0.033 to 0.112 inch (0.8 to 2.8 mm) in Thickness: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C 754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
1. Level ceiling system to a tolerance of 1/1200.
2. Laterally brace entire suspension system.
3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs as indicated in drawings.
1. Extend partition framing to structure where indicated and to ceiling in other locations.
2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.05 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C 840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 15010

MECHANICAL GENERAL

1.0 GENERAL

1.01 DESCRIPTION

A. This Division 15 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the air conditioning, ventilating, heating, fire suppression and plumbing systems as specified herein and as shown.

B. The General Provisions and Division 1, including the general, supplementary and other conditions and other Divisions, as appropriate, apply to work specified in this Division.

1.02 EXISTING CONDITIONS

A. Attention is called to the fact that the work is to be performed within an existing facility. Prior to the submission of bids, each bidder shall visit the project site, thoroughly investigate and be familiar with all existing conditions which will affect their work; especially the work.

B. Connect new work to existing work in a neat and workmanlike manner. Where an existing structure must be cut or existing utilities interfere, such obstructions shall be bypassed, removed, replaced or relocated, patched and repaired. Work disturbed or damaged shall be replaced or repaired to its prior condition.

1.03 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable standards for materials, equipment and workmanship, and to provide operable mechanical systems complete in every respect.

B. The engineering drawings are diagrammatic, intended to show general arrangement and sizes of system components, and shall not be scaled. Rather, the architectural and structural drawings shall govern space constraints, dimensions and finishes. All offsets and fittings which will be necessary to accomplish the finished installation shall be provided at no additional cost or increase in the Contract.

1.04 SPACE PRIORITY

A. Ensure optimum use of available space for materials and equipment installed above ceilings. Allocate space in the order of priority as listed below except as otherwise detailed. Items are listed in the order of priority, with items of equal importance listed under a single priority number.

1. Gravity flow piping systems

2. Vent piping systems

3. Recessed lighting fixtures

4. Concealed HVAC terminals and equipment

5. Air duct systems

6. Sprinkler piping systems

7. Pressurized piping systems

8. Electrical conduit, wiring, control air tubing

B. Order of space priority does not dictate installation sequence. Installation sequence shall be as required to install all affected trades.

C. The work of this Division 15 shall not obstruct access for installation, operation and maintenance of the work of any other Division.

D. All major items of equipment shall be arranged so as to provide a minimum of 28" clear aisle space. Additional space shall be provided between and around equipment for maintenance and proper operation as shown in the equipment manufacturer's literature.

1.05 COORDINATION

A. Coordinate all work under this Division 15 with work under all other Divisions, providing adjustment as necessary.

B. Coordination of space requirements with respect to Division 16 shall be performed such that:

1. No equipment, piping or ductwork, other than electrical, shall be installed within 42" of switchboards or panelboards.

2. No piping or ductwork which ever operates at a temperature in excess of 120 degrees F. shall be installed within 3" of any electrical conductor.

C. All items mounted in or below the ceiling, and all items penetrating the ceiling, shall be coordinated with the architectural reflected ceiling plans. If any items are not shown on these plans, or any items need to be relocated for coordination purposes, prepare a reflected ceiling plan and submit it to the ** Owner ** Architect ** for approval.

1.06 CODE COMPLIANCE

A. All workmanship and materials provided under this Division 15 shall comply with all laws, ordinances, codes and regulations of all Federal, State and Local Authorities having jurisdiction.

B. All fire suppression, plumbing, heating, ventilating, and air conditioning materials and workmanship shall comply with the following codes and standards as minimum requirements:

1. NFPA 101 Life Safety Code, 2000 Edition, with Georgia Amendments.

2. NFPA 13, Standard for the Installation of Sprinkler Systems, 2002 Edition, with Georgia Amendments.

3. NFPA 45, Standard on Fire Protection for Laboratories Using Chemicals, 2000 Edition, with Georgia Amendments.

4. NFPA 70, National Electrical Code, 2005 Edition, with Georgia Amendments.

5. NFPA 72, National Fire Alarm Code, 2002 Edition, with Georgia Amendments.

6. Georgia Accessibly Code, 120-3-20, June 25, 1997.

7. Americans with Disabilities Act, January 26, 1992.

8. ASME A17.1 Safety Code Elevators and Escalators, 2000 Edition, with 2002 Georgia Amendments.

9. International Building Code, 2006 Edition, with Georgia Amendments.

10. International Fuel Gas Code, 2006 Edition, with Georgia Amendments.

11. International Mechanical Code, 2006 Edition, with Georgia Amendments.

12. International Plumbing Code, 2006 Edition, with Georgia Amendments.

13. National Electrical Code, 2005 Edition, with Georgia Amendments.

14. International Fire Code, 2006 Edition, with Georgia Amendments.

15. International Energy Conservation Code, 2006 Edition, with 2008 Georgia Amendments.

C. Secure and pay all fees associated with all permits and licenses required for execution of the Contract. Arrange for all inspections required by city, county, state and other authorities having jurisdiction, and deliver certificates of approval to the Architect.

D. The code requirements are strictly a minimum and shall be met without incurring additions to the Contract. Where requirements of the drawings or specifications exceed the code requirements, the work shall be provided in accordance with these drawings or specifications. In the event of conflict or ambiguity between the various codes, the most stringent requirement shall govern.

1.07 ELECTRICAL REQUIREMENTS AND INTERFACE

A. All electrical equipment and wiring provided under this Division 15 shall comply with the electrical system characteristics indicated on the electrical drawings and specified in Division 16.

B. Electric controls, contactors, starters, pilot lights, push buttons, etc., shall be provided complete as part of the motor, heater or other equipment which it operates. All electrical components shall be in conformance with the requirements of the National Electrical Code and Division 16. Reference Division 16 and the electrical engineering drawings for those motor starters provided under that Division 16. All starters not shown shall be provided under this Division 15. Unless specified otherwise under other individual equipment Sections, motor starters shall conform to the following minimum requirements:

1. Starters for motors 1/3 horsepower or smaller shall be manual unless remote or automatic starting is required, in which case the starters shall be magnetic, full voltage, non-reversing, single-speed, unless otherwise indicated. All other starters shall be magnetic.

2. Each starter for a three-phase motor shall be furnished with three (3) overload relays sized for the full load running current of the motor actually provided. Provide an external "HAND-OFF-AUTO" selector switch with red "RUNNING" light. Provide a green pilot light to indicate motor "STOPPED". Each pilot light shall have a legend plate indicating reason for signal.

3. Each overload relay shall have a normally open alarm contact which will close only when actuated by an overload (not to be confused with N.O. or N.C. auxiliary contacts). These contacts shall be properly wired to their respective blue pilot light provided on the starter front cover and having a "TRIPPED" legend plate.

4. Individually mounted motor starters shall be in a NEMA Type 1 general purpose enclosure in unfinished areas and shall be flush mounted in all finished areas. All starters mounted in exterior areas shall have a NEMA 3R enclosure. Each starter shall have a laminated nameplate to indicate equipment unit number, function and circuit number.

5. All motor starters, push buttons and pilot lights shall be of the same manufacturer as the switchboard and shall be General Electric, Square D, Siemens I.T.E., or Westinghouse.

C. Motor starters for the following equipment shall be provided under this Division 15 by the manufacturer of the equipment:

1. Packaged air conditioning equipment

2. Other equipment hereinafter specified in other Sections to be provided with integral starters.

D. Unless otherwise noted or specified in individual Sections, all 3-phase motors shall be standard NEMA continuous duty "B" type, with Class B insulation, open drip-proof frame for indoor service, TEFC for outdoor service and a service factor of 1.15. All motors 5 HP and larger shall be U.S. Motors Hi-Efficiency Model or Reliance XE Hi-Efficiency Model.

E. All power wiring and final connections to equipment shall be provided under Division 16.

F. Control components, all interlocks (motor-operated dampers, fire alarm motors, etc.) and control wiring (120 volt, single phase and less) shall be provided under this Division 15 as required to achieve the specified control sequences.

G. All control wiring over 30 volts shall be installed by a licensed electrician working under this Division 15.

1.08 SLEEVES, SEALS AND ESCUTCHEONS

A. Sleeves shall be provided through all pipe penetrations of concrete or masonry walls, elevated floors and roofs, except those plumbing piping penetrations for fixtures, vents, etc.

B. Sleeves shall be fabricated from Schedule 40 steel pipe through 10" and Standard Wall steel pipe for sleeve sizes 12" and larger. All sleeves penetrating exterior walls, underground walls, pit or vault walls shall be provided with a 3" x 3/8" thick waterstop ring welded completely to the midpoint of the sleeve.

C. All sleeves penetrating exterior walls, underground walls, pit or vault walls and elevated floors shall be packed and sealed watertight.

D. Sleeves through roofs shall extend above the roof surface and be flashed watertight.

E. Sleeves through walls shall be cut and finished flush with each surface of the wall in which they are installed.

F. Sleeves shall be sized to provide a minimum of 1/2" clearance between the inside surface of the sleeve and the outside finished surface of the pipe plus any insulation specified.

G. Fire-stops shall be provided as specified herein. All annular spaces between piping and sleeves, which do not require fire-stops, shall be packed with mineral wool and caulked.

H. Provide round, chrome-plated escutcheons on all exposed piping penetrations passing through walls, floors, partitions and ceilings.

1.09 FIRE-STOPS

A. Where ductwork, piping, conduit, etc. pass through fire partitions, fire walls and floors, a fire-stop shall be provided that will ensure an effective barrier against the spread of fire, smoke and gases. Fire-stop material shall be packed tight and completely fill gaps between the ductwork, piping, conduit, etc. and the perimeter of their rough openings.

B. Fire-stopping material shall maintain its dimensions and integrity while preventing the passage of flame, smoke and gases under conditions of installation and use when exposed to the ASTM E119 time-temperature curve for a time period equivalent to the rating of the assembly penetrated. Fire-stopping material shall be noncombustible as defined by ASTM E136; and, for insulation materials, melt point shall be a minimum of 1700 degrees F. for 1-hour protection and 1850 degrees F. for 2-hour protection. Fire-stopping material shall be Dow-Corning RTV Foam or 3M Fire Barrier Products or Sohio Carborundum Fyre Putty.

C. See Section 15400 for fire stopping of PVC piping.

1.10 CORE DRILLING

A. Cutting of holes through concrete and masonry shall be by diamond core or concrete saw. Pneumatic hammer, impact electric and hand or manual hammer type drills will not be allowed, except as permitted by the Architect where required by limited working space. Locate holes such that they will not affect structural sections such as ribs or beams. Holes shall be laid out well in advance of the installation. These layout locations shall be approved by the Architect prior to drilling.

2.0 PRODUCTS

2.01 BID BASIS AND SUBSTITUTION PROCEDURES

A. Manufacturers names, series and model numbers, as noted or specified, are for the purpose of describing type, capacity, and quality of equipment, materials and products to be used. Unless "or equal" is specifically stated, bids shall be based only on the specified "basis of design" manufacturer. The listing of a particular manufacturer as an "equal" or "acceptable substitute" manufacturer shall not be misconstrued as approving nor allowing the substitution of that manufacturer's standard product in place of the basis of design. No consideration will be given to a product, which would require dimensional, spatial or aesthetic changes to the project. "Acceptable substitute" and "equal" manufacturers shall only bid those products, which exactly match the size and

other characteristics of the specified basis of design. Any changes to other disciplines and trades of work required by an "or equal" or "substitute" product shall be duly considered and priced accordingly prior to bidding or pricing. The decision as to whether or not a proposed substitute or "equal" product is actually equal to that specified shall rest solely with the Architect.

B. Requests to provide "equal" products in lieu of those specified shall be submitted to the Architect in writing at least ten (10) days prior to final pricing and execution of the Contract. No consideration will be given to substitute products after final pricing and execution of the Contract.

C. Any "or equal" product or proposed product substitution which will cause a change in the appearance, dimensions or design of any part of the building, it structure, electrical system or any other engineered systems shall be accompanied by a scaled drawing and written description of the required change(s) for approval by the Architect. If deemed necessary by the Architect, design changes shall be signed and sealed by a registered Professional Engineer, currently licensed in this State.

2.02 MINIMUM STANDARDS

A. Every piece of energy consuming equipment, all fire suppression products and life safety equipment shall comply with the following standards as applicable; especially in regard to prevailing codes:

1. Factory Mutual Laboratories (FM)

2. Industrial Risk Insurers (IRI)

3. Underwriters Laboratories, Inc. (UL)

4. ADC: Air Diffusion Council

5. AGA: American Gas Association

6. AMCA: Air Moving and Conditioning Association, Inc.

7. ANSI: American National Standards Institute

8. API: American Petroleum Institute

9. ARI: American Refrigeration Institute

10. ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers

11. ASME: American Society of Mechanical Engineers

12. ASTM: American Society of Testing and Materials

13. AWWA: American Water Works Association

14. IBR: Institute of Boiler and Radiator Manufacturers

15. MSS: Manufacturers Standardization Society

16. NBBPVI: National Board of Boiler and Pressure Vessel Inspectors

17. NEMA: National Electrical Manufacturer's Association

18. OSHA: Occupational Safety & Health Administration

19. PDI: Plumbing Drainage Institute

20. PPI: Plastic Pipe Institute

21. SMACNA: Sheet Metal and Air Conditioning Contractors National Association, Inc.

3.0 EXECUTION

3.01 SUBMITTALS

A. Before preparing submittals, study all Contract Drawings and specifications in detail, obtain manufacturer's recommended instructions, and have submittals prepared based on specific equipment and material proposed for installation. An officer of the contracting firm shall sign all shop drawings (certifying conformance with plans and specifications) before submitting to the Architect or releasing to the field.

B. The submittal process shall not be utilized as an avenue to substitute products after the execution of the contract. Should an unspecified or unequal product be submitted, it will be rejected. If a second attempt at substitution is made during the resubmittal of the same product, then no more reviews of that product will be performed without direct compensation to the Engineer being

paid for the additional services required for the third review and any further reviews.

C. No more than four (4) copies of submittal data will be reviewed. Any additional copies will be returned unmarked. The responsibility of copying review comments on any additional copies will rest solely with the Contractor.

D. Submittals will not be accepted for review unless they:

1. Comply with the requirements of Division 1.

2. Include complete information pertaining to all appurtenances and accessories.

3. Are submitted as complete packages which pertain to all related items in Division 15. Separate packages shall be submitted as follows:

a. All HVAC equipment and components

b. All plumbing equipment, fixtures and components

c. The fire suppression system

d. The automatic controls and EMS

4. Are properly marked with equipment, service or function identification as related to the project and are marked with pertinent specification paragraph number.

E. Submit catalog information, factory assembly drawings, field installation drawings and certifications as required for complete explanation and description of all items of equipment. The submittal data shall provide ample, unquestionable compliance with the Contract Documents.

F. Review of submittals shall not be construed as authorizing any deviations from the plans and specifications unless such deviations are clearly identified and separately submitted in the form of a letter that is enclosed with the submittals.

G. Submittals are required on all manufactured equipment, especially energy consuming equipment. Submittals shall include, but are not limited to, the following items of equipment:

1. Piping Specialties
2. Insulation
3. Pumps
4. Water Heaters
5. Plumbing Fixtures
6. Fire Protection System
7. Split Systems
8. Packaged Rooftop Units
9. Air Distribution Devices
10. Ductwork Accessories
11. Centrifugal Fans

3.02 EXCAVATION, TRENCHING AND BACKFILLING

A. Perform all excavation, trenching and backfilling for underground work under this Division 15. During excavation, the excavated material shall be piled back from the banks of the trench to avoid overloading, slides or cave-ins. Do not exceed the angle of repose unless written approval is obtained in advance from the Architect for shoring, bracing or other alternate excavation methods. All excavated material not used for backfilling shall be removed from the building and disposed of as indicated or directed by the Architect. Take measures to prevent surface water from flowing into trenches and other excavations and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut. Tunneling shall not be allowed.

B. The bottom of all trenches shall be evenly graded to provide firm support and an even bearing surface. Pipe shall be laid on firm soil, laid in straight lines and on uniform grades. Provide bell holes so that the barrel of the pipe rests evenly on the bottom of the trench along the entire length of the pipe.

C. Pipe shall be inspected and tested prior to backfilling. Trench shall be handfilled to a minimum of 12" above the top of pipe with suitable earth (free

of rocks, trash, large clods and organic material) and compacted to a minimum 95% proctor. After the first layer is completed, subsequent layers shall be filled and compacted the same as the first layer. Settling the backfill with water shall not be permitted.

3.03 INSTALLATION REQUIREMENTS

A. All equipment shall be installed in strict conformance with the recommendations of the equipment manufacturer, as indicated on the Drawings and as specified.

B. Provide installation manuals for each piece of equipment. Submit in separately bound volumes after review of submittals.

C. Provide supplementary steel framing and welded steel equipment support stands as required for proper hanging and support of the mechanical systems. Steel angles, channels and tubing utilized for such framing shall be selected for a maximum deflection of 1/360th of the span.

D. All roof curbs shall be a minimum of 12" high and selected for the various roof pitches. Curbs installed on roofs having pitches of not more than 1/4" per foot may be standard curbs shimmed level with steel channels or Zs to provide suitable support and flashing surfaces.

3.04 CLEANING, LUBRICATION AND ADJUSTMENT

A. The exterior surfaces of all mechanical equipment, piping, ductwork, conduit, etc., shall be cleaned and free of all dirt, grease, oil, paint splatter, and other construction debris.

B. Ducts, plenums, and air unit casings shall be cleaned of all debris and either vacuumed or blown free of all rubbish, dirt, and dust before installing grilles, registers or diffusers.

C. Bearings that require lubrication shall be lubricated in strict accordance with the manufacturers recommendations.

D. All control equipment shall be adjusted to the settings required for the performance specified.

E. Fans shall be adjusted to the speed indicated by the manufacturer to meet the installed final system pressure at the airflows indicated. Any additional sheaves

and belts required for final adjustments shall be provided with no increase in the Contract amount.

F. Any fans operated during construction shall have temporary filters. Temporary filters shall be changed regularly to minimize contamination of the equipment and duct systems. Permanent filters shall be installed prior to final inspection.

G. All coils shall be thoroughly cleaned and combed prior to final inspection.

3.05 PAINTING

A. All uncoated and uninsulated steel surfaces exposed to sight inside the building, such as piping, equipment hangers and supports which are not provided with factory prime coat or galvanizing, shall be cleaned and painted with one coat of rust inhibiting primer. In addition, all surfaces in finished spaces shall also be painted with two coats of finish paint in a color selected by the Architect.

B. All ductwork surfaces visible through grilles, registers and diffusers in finished areas shall be painted flat black.

C. Steel items exposed outside the building, such as equipment supports, uninsulated piping and hangers, which are not factory painted or galvanized, shall be cleaned and painted with one coat of rust inhibiting primer and two coats of asphaltic base aluminum paint. Insulated steel pipes outside the building shall be cleaned and painted with one coat of rust inhibiting primer before installing insulation.

D. Factory painted equipment that has been scratched or marred shall be repainted to match the original factory color.

3.06 DUCTWORK AND PIPING LEAK TESTING

A. Underground, concealed and insulated ductwork and piping shall be tested for leaks in place before backfilling, concealing or covering. Tests shall be conducted in the presence of the Architect or his designated representative.

B. All low pressure ductwork (design operating pressure of 1.0" W.C. E.S.P. or less) shall be tested by the operation of the system to which it is connected.

C. All medium and high pressure ductwork (operating pressure of more than 1.0" W.C. E.S.P.) shall be tested at 1.5 times the design operating pressure of the system to which it is connected, or at the total fan pressure at shut-off,

whichever is greater.

D. All visible and audible air leaks from the ductwork systems shall be repaired.

E. Soil, waste, storm and vent piping shall be tested with water before installing fixtures. Water test shall be applied to the system either in its entirety or to the individual sections. Each opening except the highest opening of the section under test shall be plugged, and the section shall be filled with water and tested with a head of water of at least ten (10) feet above the highest point in the system. The water shall be kept in the portion under test for at least thirty (30) minutes; no drop in the water level will be acceptable.

F. The water piping systems shall be tested at a minimum pressure of 125 psi and proved tight at this pressure for not less than thirty (30) minutes or longer if required to permit inspection of all joints. No loss in pressure will be permitted.

G. All gas piping shall be tested pneumatically and proved tight at a pressure of not less than 100 psi for a period of not less than two (2) hours. No loss in pressure will be permitted.

H. All compressed air piping shall be tested pneumatically and proved tight at a pressure of not less than 100 psi for a period of not less than two (2) hours. No loss in pressure will be permitted.

I. Chilled water, condenser water and hot water supply and return piping shall be hydrostatically tested at a pressure of 100 psig (60 psig for PVC piping) for a minimum of one hour. No loss in pressure shall be permitted.

J. Steam and condensate return piping shall be tested at a test pressure of 100 psig minimum but not less than 1.25 times the system operating pressure for a minimum of one hour. No loss of pressure shall be permitted.

K. All refrigerant piping shall be 100% tested with a halide torch leak detector.

L. All leaks shall be repaired by tightening, remaking joints, or replacing pipe and fittings. Caulking of joints shall not be permitted.

3.07 RECORD (AS-BUILT) DRAWINGS

A. At the completion of the project, provide a set of reproducible sepias to the Architect which reflect all changes, deviations and revisions made to the

original design documents. Locations of all underground piping and utilities shall be clearly shown and dimensioned from permanent reference points such as building column lines.

3.08 OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS

A. Complete operating and maintenance manuals shall be provided to the Owner. Four copies shall be provided. Each copy shall be bound in a separate 3-ring, loose-leaf notebook. Operating instructions shall be provided for each mechanical system, and shall each include a brief system description, a simple schematic and a sequence of operation. Operating and maintenance instructions shall be provided for each piece of equipment. A control system wiring diagram shall be included in each operating and maintenance manual.

B. Prior to final acceptance or beneficial occupancy, provide the services of a competent technician for not less than one (1) day to instruct the Owner in the operation of the mechanical systems.

3.09 TESTING AND BALANCING

A. Testing and balancing of the HVAC system shall be performed as specified in Section 15043. Note that this work is to be performed under a separate Contract directly under the General Contractor. Submit four (4) copies of the test and balance report directly to the Architect.

3.10 WARRANTY

A. All work provided under this Division 15 shall be subject to a minimum one year warranty. The warranty shall include prompt repair or replacement of equipment or system failures and shall include all parts and labor. In addition, all reciprocating air conditioning compressors shall carry an additional four year parts-only warranty. Extended warranties shall be provided on all other equipment so specified in other Sections.

END OF SECTION

SECTION 15043

HVAC TEST & BALANCE

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is governed by the Mechanical General Section 15010.

B. This Section 15043 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the testing and balancing (T&B) of the heating, ventilating and air conditioning (HVAC) systems as specified herein and as shown. These systems include, but are not limited to, the following:

1. Supply distribution systems

2. Return and exhaust air systems

3. Heating, ventilating and air conditioning equipment (all scheduled equipment as a minimum)

1.02 INTENT

A. It is the intent of this Section of the specifications to provide a complete operable and balanced HVAC system as shown and specified which is reasonably airtight, comfortable and free of objectionable noise and vibration.

1.03 SCOPE OF WORK

A. HVAC test and balance shall be performed by an independent agency certified by the Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB) under direct contract to the General Contractor. All work performed by this agency shall be performed by qualified technicians under the direct supervision of an AABC or NEBB certified test and balance engineer. The agency shall be independent and shall not be associated in any way with the installing HVAC subcontractor.

B. HVAC test and balance shall be performed in accordance with the 6th edition of the AABC National Standards, 2002 for Total System Balance or the NEBB

Procedural Standards for TAB of Environmental Systems, 7th Edition, 2005 together with the NEBB TAB Manual for Technicians, 2nd Edition.

C. The final T&B report shall serve to substantiate compliance with the intent of the Contract Documents, specifically the HVAC systems.

D. HVAC test and balance shall not begin until the systems are substantially complete.

E. Upon the completion of the T&B work, the Agency shall submit four copies of the complete HVAC Test and Balance Report directly to the Architect.

F. The Agency, as a part of its contract with the General Contractor, shall act as an authorized inspection agency, responsible to the General Contractor and the Architect and shall, during the test and balance, list those items which require correction or have not been installed in accordance with the Contract Documents.

G. The Agency shall plainly mark the settings of all valves, dampers and other adjustable devices. If a balancing device is provided with a memory stop, it shall be set, locked and marked.

1.04 SUBMITTALS

A. The name and certification of the Agency, along with the name and certification of the Certified Test and Balance Engineer, shall be submitted to the Architect for review within 30 days after the award of the general contract.

B. The selected Agency shall submit to the Owner:

1. Procedural Manual

2. Report Forms

3. AABC or NEBB Performance Guaranty

4. Instrument List and Calibration Dates

5. Schedule

C. A reviewed copy of each of the above shall be returned to the Agency before the HVAC Test and Balance begins.

D. If a complete submittal in accordance with these requirements is not received within 60 days from award of the general contract, then the Architect reserves the right to select the Agency.

2.0 PRODUCTS

2.01 (Not applicable).

3.0 EXECUTION

3.01 GENERAL CONTRACTOR'S DUTIES

A. The General Contractor shall provide the following, within 10 days after his receipt, to the Agency:

1. Contract drawings

2. Contract applicable specification division 15 (others as applicable)

3. Addenda

4. Change orders

5. Reviewed submittals

B. The General Contractor shall start-up and maintain the HVAC systems and shall continue the operation of the HVAC systems during each day of testing and balancing. Start-up and operation shall include, as a minimum, the following:

1. All equipment operable and in safe condition.

2. Temperature control system complete.

3. Proper thermal overload protection in place for electrical equipment.

4. Ductwork leakage rates not exceeding those specified and all duct systems clean of debris.

5. Air transfer systems shall have:

a. Correct fan rotation and RPM.

b. Coil fins cleaned and combed.

c. Filters clean and in place.

d. Access doors closed.

e. All dampers in place and open.

f. All grilles, registers and diffusers installed.

C. Provide sufficient time before final completion date so that testing and balancing can be accomplished. Coordinate the submitted T&B schedule.

D. Provide immediate labor and tools to make required corrections and repairs without undue delay.

E. The General Contractor and his subcontractors shall cooperate fully with the Agency to provide the following:

1. Access to HVAC system components.

2. The right to adjust the systems.

F. Any conditions which prevent a proper HVAC Test and Balance shall be reported by the Agency to the General Contractor and Architect within 7 days of their discovery.

G. If it is determined by the Agency and confirmed by the Architect that drive changes or additional balancing dampers are required, the Contractor shall obtain and install all necessary components.

H. The Agency shall cooperate with the Architect and the Contractor and all his subcontractors to perform the work in such a manner as to meet the job schedule.

I. The Agency shall verify that all system components are in place and in proper working order prior to leaving the project.

J. All reported, recorded data shall represent true measured conditions.

END OF SECTION

SECTION 15066

REFRIGERANT PIPING SYSTEMS

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is governed by the Mechanical General Section 15010.

B. This Section 15066 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the piping systems as specified herein and as shown for the heating, ventilating and air conditioning (HVAC) systems. These piping systems include, but are not limited to, the following:

1. Refrigerant suction and liquid (RS&RL)

2. Condensate drains (DR)

1.02 INTENT

A. It is the intent of this Section of the specifications to provide complete and operable piping systems as shown and specified which are free of leaks, properly vented, free of noise, vibration and sweating, and fabricated so as to fit the space allotted and to exhibit a minimum resistance to fluid flow. It is also the intent of this Section of the specifications to provide a complete piping insulation system which is free of gaps and tears, properly fitted and finished, free of sweating, and fabricated so as to fit the space allotted and to exhibit a negligible heat transfer.

B. The word "piping" is defined to mean all piping, fittings, joints, hangers, coatings, valves, test and sensor wells and accessories necessary for the refrigerant piping systems described, shown and specified.

1.03 GENERAL REQUIREMENTS

A. Provide all reducing fittings, flanges, couplings and unions of the size and type of material to match the piping to each piece of equipment, valve and accessory.

B. Union joints, couplings or flanges shall be provided in each pipe line connected to each piece of equipment and elsewhere as indicated and specified. Unions shall match the piping system in which they are installed.

1. Unions or flanges shall be provided between all copper to steel connections in water-carrying piping. These unions shall be dielectric, insulating type.

C. All changes in direction and branches shall be made with manufactured fittings.

D. All pipe joints shall be cut square and all burrs shall be removed.

E. Fabrication of a bull-head tee connection is strictly prohibited.

F. Open ends of pipe lines not currently being handled shall be plugged during installation to keep dirt, water and foreign material out of the system.

G. Horizontal refrigerant and drain piping shall slope down in the direction of flow at a minimum slope of 1/8" per foot of run.

H. All insulation products installed indoors shall meet NFPA 90A, 90B and 255 requirements for Flame Spread Rating 25 and Smoke Developed Rating 50.

1.04 FIRE-STOPS

A. Where pipes pass through fire partitions, fire walls and floors, install a fire-stop that shall provide an effective barrier against the spread of fire, smoke and gases. Fire-stop material shall be packed tight and completely fill clearances between pipes and openings. Fire-stop material shall conform to the following:

1. Fire-stopping material shall maintain its dimensions and integrity while preventing the passage of flame, smoke and gases under conditions of installation and use when exposed to the ASTM E119 time-temperature curve for a time period equivalent to the rating of the assembly penetrated. Fire-stopping material shall be noncombustible as defined by ASTM E136; and in addition for insulation materials melt point shall be a minimum of 1700 degrees F. for 1-hour protection and 1850 degrees F. for 2-hour protection. Fire-stopping material shall be Dow-Corning RTV Foam or an approved equal.

1.05 ACCEPTABLE MANUFACTURERS

A. Insulation products shall be as manufactured by Rubatex or Armstrong.

2.0 PRODUCTS

2.01 PIPE AND FITTINGS

A. All pipe and fittings shall be products of a domestic manufacturer.

B. Pipe and fittings shall be as listed and outlined below:

	SERVICE	MATERIAL TYPE	SIZES
1.	Refrigerant Suction and Liquid	1	All
2.	Drains*	2	All

*Note: As an option, on cooling coil condensate drains (which are not installed in a plenum) the drain piping may be schedule 40 PVC with solvent joints; subject to advance approval by the Local Authorities. Fittings shall meet ASTM D2466 and solvent shall meet ASTM D2564.

C. The pipe, fittings and joints shall be as outlined below:

1. Material Type 1:

   a. Pipe - Type L hard drawn copper tubing meeting ASTM B88 or ASTM B280.

   b. Fittings - Wrought copper meeting ANSI B16.22.

   c. Joints - Silver brazed with sil-fos or silver solder.

2. Material Type 2:

   a. Pipe - Copper drainage tube DWV meeting ASTM B306.

   b. Fittings - Wrought copper solder-joint drainage fittings meeting ANSI B16.29.

   c. Joints - Soldered with a solder meeting ASTM B32.

2.02 PIPE HANGERS AND SUPPORTS

A. Pipe hangers, trapeze hangers, upper attachments, rods and other supports shall be selected based on pipe size and material contained therein. Provide all hangers, rods, turnbuckles, angles, channels and other supports to securely support the piping systems from the building structure.

B. All materials utilized for the hanging and support of the piping systems shall be manufactured products which are specifically intended for the purpose of hanging piping systems. The use of wire, steel straps, plastic ties, etc. is strictly prohibited.

C. Supports and hangers shall be selected to fit around the pipe (and insulation unless otherwise specified herein) and provide adequate movement for expansion of the piping systems. Anchors shall be provided to restrict and control such movement within offsets and expansion loops.

D. All hangers and supports shall be selected at a minimum factor of safety of five based on the ultimate tensile strength of the material.

E. Intermediate pipe supports shall be provided between building structural members so as not to exceed maximum support spacing specified and shall be structural steel angles (minimum 2 1/2" x 2 1/2" x 1/4"). In steel construction, intermediate supports shall be securely clamped to steel beams and to steel joists, and in no case shall supports be attached to roof decks.

F. For suspending pipes from concrete beams, upper attachments shall be side beam bracket utilizing bolts in sleeves set in top portions of the beams. Where sleeves are not used, provide expansion shields or power-actuated fasteners.

G. Hanger rods for pipe hangers shall be as follows:

HANGER ROD SIZE	NOMINAL PIPE SIZE
3/8"	2" and smaller
1/2"	2 1/2" and larger

H. Pipe hangers selected for supporting horizontal insulated piping shall be sized to fit around the outside of the pipe insulation.

I. Provide pipe saddles and shields on all insulated piping as outlined below:

1. All insulated piping shall be supported on galvanized shields.

   a. Shields shall be as follows:

      1) Pipes 2" and smaller: 18 gauge x 12" long.
      2) Pipes 2 1/2" and larger: 16 gauge x 18" long.

   b. Shields shall be 180 degrees around the lower half of the pipe at all pipe hangers, except that on trapeze hangers, pipe racks and floor supported horizontal pipes, shields shall be 360 degrees around the entire pipe.

J. Provide riser clamps at all floor penetrations.

2.03 VALVES

A. All valves shall have the manufacturer's name or trademark and the working pressure cast or stamped on the valve body.

B. All valves shall be designed and constructed for refrigerant service.

2.04 PIPING INSULATION

A. Closed-cell insulation shall be provided over all refrigerant suction piping and other services as specified or noted. Closed-cell piping insulation shall be 1/2" thick 25/50 Armaflex or Rubatex. All glues and coatings shall be products of the same manufacturer as the insulation.

B. Insulation shall be continuous over all valve bodies, fittings, and wall and floor penetrations.

3.0 EXECUTION

3.01 ARRANGEMENT

A. Piping shall follow the general layout, arrangement, schematics, and details. Provide all offsets, vents, drains, charging ports and connections necessary to accomplish the installation. Fabricate piping accurately to measurements established at the project site to avoid interference with ductwork, other piping, equipment, openings, electrical conduits and light fixtures. Make suitable provision for expansion and contraction with expansion loops and offsets.

3.02 MINIMUM HANGER SPACING

A. Pipe hangers or supports shall be provided within 18" of each horizontal fitting, equipment connection, valve, etc. and at not more than the following spacings along horizontal runs of straight, plain piping:

	Pipe Size	Maximum Span
1.	2" and smaller	8 ft.
2.	2 1/2" and larger	12 ft.

B. Riser clamps shall be provided at each floor penetration.

3.03 UNDERGROUND PIPING

A. All underground piping shall have a minimum cover of 2'-0".

B. All underground copper lines shall be protected from corrosion with a continuous plastic sheathing or coating and wrapping. This sheathing or coating and wrapping shall be extended 6" to 12" above finished floor.

3.04 REFRIGERANT PIPING INSTALLATION

A. All refrigerant piping shall be sized in accordance with the air conditioning equipment manufacturer's written instructions. Provide charging ports, solenoid valves, service valves, dryers, etc. at each piece of equipment.

B. All brazing shall be done while the line is being flushed with carbon dioxide, nitrogen or other inert gases.

C. The inside of all tubing shall be thoroughly cleaned and internally wiped with a lintless, dry cloth.

D. Suction lines shall drop below their coils before any horizontal run.

E. Provide oil traps at least every ten feet for extended vertical risers.

F. All oil traps shall be constructed from close-radius type fittings.

G. Dryer cores shall be installed to remove horizontally or downward.

H. Install external equalizer downstream of its expansion valve sensing bulb.

I. Install expansion sensing valve bulb on top centerline of piping up to 5/8" size; install 45 degrees down from the horizontal centerline on pipe sizes 7/8" and larger.

3.05 CLOSED-CELL PIPING INSULATION INSTALLATION

A. Insulation shall be provided on all refrigerant suction and indoor condensate drain lines. The insulation shall be installed by the slip-on method; slitting of the insulation is prohibited and shall be cause for rejection. All elbows shall be mitered and all such joints and butt joints shall be tightly made and glued.

B. All insulation installed outdoors shall be coated with a glossy white, ultraviolet protective coating applied in two coats; Armacote or approved equal.

END OF SECTION

SECTION 15400

PLUMBING SYSTEMS

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is governed by the Mechanical General Section 15010.

B. This Section 15400 and the accompanying drawings cover the provision of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the plumbing systems as specified herein and as shown. These systems include, but are not limited to, the following:

1. Sanitary waste and vent systems.

2. Domestic water systems.

C. Provide all final plumbing connections to all equipment furnished by Owner.

D. Provide gate valve and reduced pressure backflow preventer or vacuum breaker at the service entrance and at those connections (especially to kitchen equipment) required by local plumbing code.

1.02 INTENT

A. It is the intent of this Section of the specifications to provide complete and operable plumbing systems as shown and specified which are free of leaks, properly vented, free of unreasonable noise, vibration and sweating, and fabricated so as to fit the space allotted and to exhibit a minimum resistance to fluid flow.

B. The word "piping" is defined to mean all piping, fittings, joints, hangers, coatings, valves, cocks, insulation and accessories necessary for the plumbing systems described, shown and specified.

1.03 GENERAL REQUIREMENTS

A. Provide all reducing fittings, flanges, couplings and unions of the size and type of material to match the piping connections at each fixture, piece of equipment,

valve and accessory.

B. Union joints, couplings or flanges shall be provided in each pipe line connected to each piece of equipment, fixture and elsewhere as indicated and specified, Unions shall match the piping system in which they are installed.

1. Unions or flanges shall be provided between all copper to steel connections. These unions shall be dielectric, insulating type.

C. All changes in direction and branches shall be made with manufactured fittings.

D. The use of offset-type reducers is strictly prohibited in any piping system.

E. In all water piping systems, changes in horizontal pipe line sizes shall be made with eccentric reducers installed flat on top for proper air venting. Reducing tees, reducing elbows and concentric reducers shall only be allowed in water piping systems for changing pipe sizes in vertical risers and for making connections to equipment and accessories from vertical risers.

F. All pipe joints shall be cut square and all burrs shall be removed.

G. Open ends of pipe lines not currently being handled shall be plugged during installation to keep dirt, water and foreign material out of the system.

H. Sanitary waste and storm drainage piping shall slope down in the direction of flow as shown on the drawings or as prescribed by Code, but not less than 1 percent.

I. All vents through roof (VTR'S) shall be offset just below the roof such that their termination points are at least 10 ft. from any outside air intake of any HVAC unit; special attention is called to packaged rooftop units.

J. Trap primers shall be provided at all floor drains and hub drains.

1.04 IDENTIFICATION OF PIPING

A. All aboveground plumbing systems piping and valves sized 3/4" and larger which are installed in accessible locations (including piping above removable ceilings and behind access panels) shall be identified in strict conformance with the "Scheme for the Identification of Piping Systems" (ANSI A13.1 - 1981).

B. Each identification marker shall include the following:

1. Proper color-coded background.

2. Proper color of legend in relation to background color.

3. Proper legend letter size.

4. Proper marker length.

5. Direction of flow arrow shall be included on each marker.

C. Locations for pipe markers shall be as follows:

1. Adjacent to each valve and fitting.

2. At each branch and riser take off.

3. At each pipe passage through walls, floors and ceilings.

4. On all straight pipe runs every 25 feet.

D. Identification markers may be stenciled or shall be Setmark Pipe Markers, as manufactured by Seton Name Plate Corporation.

E. All valves shall be identified with the appropriate service designation and valve number brass valve tags. Each valve tag shall be 19 gauge brass with 1/4" black-filled letters over 1/2" black-filled numbers. Tags shall be fastened to valves with brass "S" hooks or brass jack chain. Brass tags and fasteners shall be as manufactured by Seton Name Plate Corporation

F. Provide charts of all valves. Valve charts shall include the following items:

1. Valve identification Number

2. Location

3. Purpose/Material

2.0 PRODUCTS

2.01 SANITARY WASTE AND VENT SYSTEMS

A. All underground sanitary waste and vent piping shall be PVC, DWV Solid Wall

Schedule 40 with socket-type, solvent welded joints in sizes up to 12"; all 15" piping shall be PVC, DWV Solid Wall Schedule 40 with socket-type, solvent welded joints.

B. Cleanouts shall be provided at the locations indicated and, as a minimum, where required by Code. Floor cleanouts shall be a minimum of 4" and shall be complete with a flush plug and removable, scoriated bronze floor plate. Provide carpet buttons in carpeted areas.

C. Joints on hubless cast iron soil pipe shall be made with neoprene couplings and stainless steel clamps.

D. All aboveground sanitary, waste and vent piping shall be **PVC DWV Solid Wall Schedule 40 with socket-type, solvent welded joints; except that sanitary, waste and vent piping located within return air plenums or as noted on plans shall be hubless cast iron soil pipe.

E. Floor drains in toilets and finished areas shall be J. R. Smith 2000 Series with 6" Type B square adjustable strainers finished in satin nickel bronze; or equal products by Josam or Zurn. Provide vandalproof secured tops. All floor drains shall be provided with a trap primer.

F. Floor drains in mechanical rooms and unfinished concrete floors shall be J. R. Smith 2131 Series with round 11 3/4" cast iron grate, sediment bucket and deep-seal P-trap; or equal products by Josam or Zurn. Provide vandalproof secured tops. All floor drains shall be provided with a trap primer.

2.02 DOMESTIC WATER SYSTEM

A. Underground domestic water service entrance piping 3" and smaller in size shall be Type K hard drawn copper tubing with wrought copper fittings. All joints shall be brazed.

B. All underground copper branch lines (1/2" and 3/4" only) shall be continuous lengths of soft Type K copper tubing with no joints allowed underground.

C. Underground domestic water service entrance piping above 3" in size shall be Class 150 ductile iron pipe with mechanical joints.

D. Aboveground domestic water system piping 3" in size and smaller shall be Type L hard drawn copper tubing with wrought copper fittings and soldered joints.

E. Aboveground domestic water piping 4” and larger shall by Type L hard drawn copper tubing with rolled grooved joints and fittings.

F. Gate valves 3" or less in size shall be constructed with a bronze body, non-rising stem. Stem to be bronze ASTM B-62 or silicon bronze ASTM B-371 with malleable iron handwheels. Valve shall meet MSS-SP80. Valve shall be manufactured by Milwaukee, Hammond, Nibco or Stockham.

G. Ball valves 2 inch and smaller:

1. Ball valves shall be two piece bronze body, large port with solid, smooth bore chrome plated brass ball, meeting MSS-SP110. Seats shall be reinforced TFE with Teflon packing ring and threaded adjustable packing nut. Valves on insulated lines will be provided with stem extensions to provide clearance for two inches of pipe insulation. Valves to be Apollo 70, Hammond 8501 or Watts B-6000.

H. Non-freeze wall hydrants (NFWH) shall be non-freeze, bronze box type with vacuum breaker, loose key and wall clamp. Finish shall be rough bronze. Wall hydrants shall be Smith 5509QTPB or approved equal by Josam or Zurn.

I. Backflow preventers shall be Watts Series 909 reduced pressure principle backflow preventers complete with strainer and shut-off valves. Air gap drain shall be piped into nearest floor drain or outside of building to a concrete splashblock.

J. Water pressure reducing valves (PRV) shall be the self-contained direct operating type with bronze body, stainless steel seat, stainless steel spring, and sealed spring cage. The strainer shall have bronze body with 20 mesh stainless steel screen. Strainer shall be attached with a bronze nipple. The unit shall be constructed in accordance with ASSE Standard 1003 and shall bear the seal of approval. The capacities shall be based on maximum reduced pressure fall-off, as defined in the ASSE Standard, of 10 pounds. Pressure regulators shall be Watts Regulator Company's Series 223S or approved equal.

K. All water hammer arresters (WHA) shall be PDI Certified, Size A, B, C, D, E or F, as indicated for the fixture units served; Josam, Jay R. Smith or Zurn.

L. Soldered joints shall be made with tin-antimony/silver solder. Solder containing lead shall not be permitted.

2.03 PLUMBING INSULATION

A. All pipe insulation products shall have a permanent composite insulation, jacket and adhesive fire and smoke hazard rating as tested by procedure ASTM-84, NFPA 255 and UL 723 not exceeding Flame Spread 25 or Smoke Developed 50.

B. Blanket-type insulation shall have an average thermal conductivity not to exceed 0.27 BTU-in. per sq. ft. per degrees F. per hour at a mean temperature of 75 degrees F. Insulation shall have a minimum density of 1 lb./cu.ft. and shall be 2" thick.

C. Preformed insulation for all domestic hot and cold water piping shall be minimum 1" thick preformed fiberglass pipe insulation with white all-service jacket. All longitudinal joints shall be lapped, self-sticking type with all butt joints, tears, etc. sealed with a matching white vapor barrier tape. Elbows shall be mitered or may be Zeston covers filled with equivalent fiberglass insulation. The maximum K value of the insulation shall be 0.23 at 70 degrees F.

2.04 PIPE HANGERS AND SUPPORTS

A. Pipe hangers, hanger rods, trapeze type hangers, upper attachments and other supports shall be selected based on pipe size (plus insulation of pipes specified to be insulated) and the weight of the medium being transported or the medium used for testing, whichever is greater. Provide all hangers and rods, turnbuckles, angles, channels, and other structural supports to support the piping systems. Rods for pipe hangers shall be full size of the hanger manufacturer's catalog listed rod size for each type hanger specified. Hangers and supports shall be Michigan, ITT Grinnell or B-Line.

B. All material utilized for the hanging and support of the piping systems shall be manufactured products which are specifically intended for the purpose of hanging piping systems. The use of wire, steel straps, plastic ties, etc. is strictly prohibited.

C. Pipe hangers selected for supporting horizontal insulated piping shall be sized to fit around the outside of the pipe insulation. Insulated piping shall be supported on galvanized shields.

1. Shields shall be as follows:

a. Pipes 2" and smaller: 18 gauge x 12" long.

b. Pipes 2 1/2" and larger: 16 gauge x 18" long.

2. Shields shall be 180 degrees around the lower half of the pipe at all pipe hangers, except that on trapeze hangers, pipe racks and floor supported horizontal pipes, shields shall be 360 degrees around the entire pipe.

D. Pipe hangers for copper piping shall be copper plated or the piping shall be dielectrically isolated from any steel hangers or clamps that are used.

E. Steel rods, framing and clamps shall be plated or primed to prevent rust formation.

3.0 EXECUTION

3.01 ARRANGEMENT

A. Follow the general piping layout, arrangement, schematics and details. Provide all offsets, vents, drains and connections necessary to accomplish the installation. Fabricate piping accurately to measurements established at the project site to avoid interference with ductwork, other piping, equipment, openings, electrical conduits and light fixtures. Make suitable provision for expansion and contraction with expansion loops and offsets.

B. Water hammer arresters shall be installed at the top of each riser and on each fixture branch in accordance with Plumbing and Drainage Institute Standard WH201.

C. Cleanouts shall be provided at the base of all sanitary and storm risers.

3.02 UNDERGROUND WATER PIPING

A. All underground domestic water piping shall have a minimum cover of 3'-0".

B. Provide concrete thrust blocks at all changes of direction and secure all mechanical joints with restraining rods.

C. All underground copper water lines shall be protected from corrosion with a continuous plastic sheathing or coating and wrapping. This sheathing or coating and wrapping shall be extended 6" to 12" above finished floor.

3.03 MINIMUM HANGER SPACING

A. Pipe hangers or supports shall be provided within 18" of each horizontal fitting, equipment connection, valve, etc. and at not more than 10 ft. spacings along

horizontal runs of straight, plain piping.

B. Riser clamps shall be provided at each floor penetration.

3.04 FIRESTOPPING PVC PIPING

A. PVC, soil, waste and vent stacks penetrating fire-rated floors and walls shall be flamestopped, firestopped, and waterproofed using ProSet Systems, Inc. Series 45 "Firestop" couplings and Series 90 "Code Red" firestop devices. All other PVC drain, waste, and vent piping penetrating fire-rated floors shall be firestopped and waterproofed using ProSet Systems Series 48 closet stubs, tub boxes, floor drains, shower drains, and "E-Z Flex" flexible couplings. All shall be installed in accordance with the manufacturer's instructions.

B. ProSet "Firestop" couplings used in the DWV system shall be of type I PVC conforming to ASTM D2665 standard. ProSet "Code Red" stack fittings shall be of gray cast iron conforming to ASTM A-48 standard. ProSet "E-Z Flex" connector couplings shall be of flexible PVC conforming to ASTM C594 and ASTM F477 performance standards. Band used for compression joint on the "E-Z Flex" coupling shall be #300 stainless steel. IPS P-70 Primer and Weld-on 795 cement or equal shall be used for all solvent welds in the system.

3.05 INSULATION INSTALLATION

A. Provide blanket insulation over all horizontal roof drain piping which is within the building and including the vertical risers to the roof drains and the underbody of the roof drains.

1. Blanket insulation shall be wrapped around the piping and underbodies of roof drains. Ends of insulation shall overlap at least 2" and bottom of insulation shall overlap pipe insulation at pipe connection to roof drain at least 3". Adhere insulation to roof drain underbodies with 100% coverage of fire retardant adhesive and tape all joints with 3" wide foil reinforced kraft tape.

B. Provide insulation over all above ground hot and cold water piping, except that no insulation is required on cold water lines installed inside interior plumbing chases (those chases with no exterior wall).

1. All joints and tears shall be sealed with matching white vapor barrier tape.

3.06 PIPING INSTALLATION ABOVE CEILINGS

A. All domestic hot and cold water piping installed above the insulated ceilings shall be installed just above (within 2") of the top of the finished ceiling with the building insulation over the piping to avoid freeze-up.

3.07 DISINFECTION

A. All domestic water piping installed under this Division shall be disinfected with chlorine before it is placed into operation. The chlorinating material shall be liquid chlorine conforming to Federal Specification BB-C-120 and shall be introduced to the system by experienced operators only. The chlorine solution applied to the piping sections or system shall contain at least fifty parts per million of available chlorine and shall remain in the sections or system for a period of not less than sixteen (16) hours. During the disinfection period, all valves shall be opened and closed at least four times. After the disinfection period, the chlorinated water shall be flushed from the system with clear water until the residual chlorine content is not greater than two-tenths parts per million (0.2 PPM). Submit certification to the Architect that the system was disinfected.

END OF SECTION

SECTION 15424

WATER HEATERS AND ACCESSORIES

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is governed by the Mechanical General Section 15010.

B. This Section 15424 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the water heating systems as specified herein and as shown. These systems include, but are not limited to, the following:

1. Water heaters

2. Hot water circulator

2.0 PRODUCTS

2.01 INSTANTANEOUS WATER HEATERS

A. Instantaneous water heaters shall be electric instantaneous type, as scheduled on the plans.

B. Water heater shall be U.L. listed, complete with thermostat and an ASME temperature and pressure relief valve.

C. Water heater shall be a Chronomite or an approved equal.

2.02 WATER HEATER COMMERCIAL ELECTRIC

A. The water heater shall be A.O. Smith Conservationist Series Model with three (3) elements or DEL Series, as scheduled on the plans.

B. Water heater shall have an approved working pressure of 150 psi. The tank shall be glass-lined and shall have a magnesium anode to provide electrolytic protection. The entire heater shall be UL listed, shall meet or exceed the ASHRAE Standard 90 for energy efficiency and shall be insulated with high

density polyurethane foam insulation for maximum heat retention.

C. Controls shall include an operating thermostat and manual reset high limit control. All controls shall be factory-wired and require no external power source.

D. Water heater shall be provided with access door and ASME T&P relief valve.

2.03 HOT WATER CIRCULATOR

A. Hot water circulator shall be Bell & Gossett as scheduled on plans.

3.0 EXECUTION

3.01 INSTALLATION

A. The water heaters and accessories shall be installed in strict accordance with the manufacturer's recommendations and the Contract Documents.

B. All temperature and pressure relief valves shall be piped full size to an indirect waste such as the nearest floor drain, service sink, sink tailpiece, etc.

END OF SECTION

SECTION 15450

PLUMBING FIXTURES AND TRIM

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this section is governed by the Mechanical General Section 15010.

B. This Section 15450 and the accompanying drawings cover the provisions of all labor, fixtures, equipment, appliances and materials, and performing all operations in connection with the construction and installation of the plumbing fixtures and trim as specified herein and as shown.

C. All exposed piping, valves, stops, P-traps, etc. shall be chrome-plated. Also, all exposed piping penetrations through walls, floors or ceilings shall be provided with chrome-plated cast brass escutcheons.

D. All P-traps shall be minimum 17-gauge brass.

E. Flush valves shall have non-hold open feature, vacuum breakers and cover cap on angle-type stop.

F. Provide all final connections to all equipment and fixtures furnished by Owner.

G. Unless otherwise specified in an individual fixture description, all enameled cast-iron and porcelain fixtures shall be white.

1.02 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted, clean plumbing fixtures as shown and specified, which are free of leaks, noise, air, vibration and waterflow fluctuations.

1.03 BASIS OF DESIGN

A. The basis of design is as outlined for each fixture in the 2.0 PRODUCTS subsection. Any proposed substitutions shall be proven equal in all respects to the equipment specified as the basis of design.

1.04 ACCEPTABLE MANUFACTURERS

A. Acceptable fixture manufacturers are American Standard, Zurn, Falcon and Kohler, provided that their units are equal in all respects for this specific project. Faucets and trim may be equal products as manufactured by Chicago, Delany, Zurn, T&S Bronze, Brass Craft, Speakman and McQuire.

B. Flush valves may be equal products by Sloan, Zurn and Delany. Stainless steel sinks and drinking fountains shall be as manufactured by those companies specified for each specific item outlined under subsection 2.0 PRODUCTS.

2.0 PRODUCTS

2.01 PLUMBING FIXTURES

A. Refer to architectural plans for fixture specifications.

3.0 EXECUTION

3.01 INSTALLATION

A. Units shall be installed as indicated and in conformance with the manufacturer's recommendations. Coordinate the actual units to be provided with all trades.

B. All plumbing fixtures shall be free of leaks, provided completely finished, trimmed, adjusted, cleaned and ready for use. They shall be properly secured to the structure by the use of thru-bolting, backplates, carriers, expansion shields (for floor mounting only) or toggle bolts.

C. Wall hung fixtures supported on chair carriers shall be bolted to the floor slab. Carefully coordinate space requirements and fixture mounting height requirements with supports being furnished.

D. Fixtures supported with wall hangers on masonry chase walls shall be fastened to the wall with not less than 3/8" bolts which shall pass through the wall and through a 1/4" x 4" wide steel backplate on the unfinished chase wall side.

E. Where fixtures are hung on single masonry walls without a pipe chase behind, they shall be mounted with 3/8" toggle bolts.

F. Fixtures on steel stud walls shall have a 1/4" x 4" wide steel backplate wired with 1/16" steel wire to the studs. Bolts not less than 3/8" shall secure the fixtures

through the fixture hanger and the backplate.

G. All mounting holes provided in fixtures shall be used for support. In addition to the main hangers, 1/4" toggle bolts shall secure the bottom of all wall hung fixtures at each drilling provided for this purpose.

H. Mount wall-hung fixtures at the heights indicated on the Architectural Drawings or as prescribed by local code. Special attention is called to the installation requirements of the ANSI Handicap Code.

3.02 CLEANING AND ADJUSTMENT

A. The units shall be cleaned, tested and field-adjusted to provide optimum flow and drainage.

END OF SECTION

SECTION 15525

FIRE SUPPRESSION SYSTEMS

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is governed by the Mechanical General Section 15010.

B. This Section 15525 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the engineering, design and construction of the fire suppression systems as specified herein and as shown.

C. Attention is called to the different hazards, classes and types of fire suppression systems required within the facility. Systems shall include, but not be limited to the following:

1. Light hazard

2. Ordinary hazard

D. The work included under this Section 15525 shall include, but is not limited to, the following:

1. Risers including all check valves, indicator valves, alarms, etc.

2. Standpipes, hose connections, hose cabinets and hoses

3. Siamese connections

4. Piping and sprinkler heads

5. Hydraulic design computations

6. Shop drawings and procurement of all approvals

1.02 STANDARDS AND APPROVALS

A. The standpipes and sprinkler systems shall be designed and installed in conformance with the applicable standards of NFPA 13, NFPA 14, NFPA 20, NFPA 24, NFPA 72, Underwriters Laboratories (UL), the standards of the Underwriter (IRI/FM/ISO) and local codes.

B. The hydraulic calculations, standpipes and sprinkler system design and installation shop drawings shall be submitted and approved by the Owner's Underwriter and the Fire Marshal.

C. The standpipes and sprinkler systems shall be installed by a firm which is duly licensed to install such systems in the State of Georgia and carries a current certificate from the Georgia State Fire Marshal's Office.

1.03 RECORD DRAWINGS

A. Upon completion of the work, provide record as-built documentation of the fire protection systems as actually installed to the Owner. Drawings shall be to scale, and shall include all details required to accurately indicate the system as installed. Record drawings shall be produced in electronic format compatible with AUTOCAD 2006. Furnish two (2) CD's with all drawings in dwg. format, one (1) vellum copy and two (2) bond copies of all drawing sheets.

1.04 IDENTIFICATION

A. All control, check, drain, test and alarm valves and alarms shall be provided with identification signs of the standard design as adopted by the sprinkler industry and as recommended for the particular services. The signs shall be securely attached to each piece of equipment.

1.05 HOSE THREADS

A. Hose threads shall conform to the standards of the local Fire Department. The exact threads used shall be verified with the Fire Department before ordering materials.

2.0 PRODUCTS

2.01 MINIMUM QUALITY LEVEL

A. All equipment and materials provided under this Section 15525 shall be new and of the best grade commercial quality, shall be of the latest design of the

manufacturer, and shall be listed and approved by U.L. and the Underwriter. Materials and equipment manufactured outside of the United States will not be acceptable. All components shall be suitable for the pressures indicated on the flow test.

2.02 VALVES

A. Materials shall be as follows:

1. Valves 2" and smaller: Bronze body

2. Valves over 2": Iron body with bronze trim

B. Connections shall be as follows:

1. Valves 4" and smaller: Threaded or flanged

2. Valves over 4": Flanged

C. Gate valves shall be double seat; type as follows:

1. Valves 2" and smaller: Rising stem type, except where space requires non-rising stem, solid wedge with union bonnet and replaceable seat rings.

2. Valves over 2": Outside screw and yoke type with solid wedge and replaceable seat rings.

D. Butterfly valves shall have bronze or ductile iron discs, stainless steel shaft and lock bolts, Buna N liner and as follows:

1. Valves through 6": Full lug type with lever operators

2. Valves over 6": Full lug type, gear operators

E. Fire department valves (FDV) shall be 2 1/2" screwed, U.L. approved, brass hose valves for working pressure of 175 psig with 2 1/2" male hose threads, 1 1/2" removable reducer, polished brass cap and chain.

F. Swing checks shall be gravity operated with renewable composition discs. Wafer checks shall have renewable clapper facings and non-stick coated

clappers, valve shall be approved for both horizontal and vertical installation.

G. All valves shall comply with requirements of NFPA and shall be Underwriters' Laboratories, Inc. (UL) listed.

H. Working pressure of all valves shall be minimum **175/300** psig at 70 degrees F. water temperature.

I. All valves utilized for shut-off service shall be lockable in the open position.

J. Alarm valves shall have electrical circuit closers.

2.03 ROOF MANIFOLDS

A. Roof manifolds shall be Y-type, 4" x 2 1/2" x 2 1/2"; brass construction complete with caps and chains.

2.04 FIRE DEPARTMENT SIAMESE CONNECTIONS

A. Provide 2-1/2" x 2-1/2" x 4", chrome plated, lettered **"Standpipe & Auto-Spkr"**, threads to match local Fire Department, with caps and chains.

2.05 DRAINS

A. Drains shall be provided in all risers and auxiliary drains at all low points in the system. Inspector's test drains shall be installed on each sprinkler system.

B. Pipe the main drain and test lines full size to the outside. Do not spill on walkways.

C. Pipe small drips and drains to the outside of the building or to an indirect drain within the building.

2.06 WATER FLOW SWITCHES

A. Water flow switches with normally closed electrical contacts shall be provided in all required locations to open the electrical contacts at any time water flows in the associated riser or zone piping system.

2.07 TAMPER SWITCHES

A. Tamper switches with normally closed electrical contacts shall be provided in all required locations to open the electrical contacts at any time the associated valve is not fully open.

2.08 ALARM SYSTEM

A. Provide interlocks to the building fire alarm system to provide automatic signaling to an approved remote location with adequate dialing and communication system to alert the local fire department. Connection and leased line shall be provided by owner.

2.09 SPRINKLER HEADS

A. All sprinkler heads shall be automatic, closed-type standard spray heads.

B. Sprinkler Heads in Ceilings:

1. All areas with suspended ceilings shall have heads equal to Reliable Model G, semi-recessed type. Finish shall be as selected by the Architect.

2. All public areas shall be provided with concealed, fully recessed heads. Finish shall be as selected by the Architect.

3. All leasable future tenant areas with suspended acoustical tile ceilings shall have heads equal to Reliable Model G, semi-recessed type. Finish shall be as selected by the Architect.

C. Sprinkler heads installed in storage, utility, mechanical equipment rooms and similar "back-of-house" areas without ceilings shall be bronze heads in the upright position unless otherwise noted.

D. The temperature rating of the sprinkler heads shall be in accordance with applicable code and the recommendations of the Underwriter.

E. Sprinkler guards shall be provided for all heads within seven feet of the floor, in mechanical, electrical and storage rooms, and elsewhere as required by the Underwriter.

F. Provide to the Owner a cabinet containing two (2) head wrenches and a minimum of six (6) spare heads of each type and temperature rating used in the

systems.

G. All heads installed in areas with tile ceilings shall have the heads centered in the tile.

2.10 PIPING

A. Piping shall be Schedule 40, grade A53 or A120; except that Schedule 10 piping is acceptable on pipe sizes 2 1/2" and larger where permitted by the applicable codes and standards. Schedule 10 piping shall not be threaded nor cut-grooved. Couplings and fitting shall be Victaulic.

B. The use of light-wall threaded pipe such as Allied XL is prohibited.

C. At the contractor's option, individual drops to sprinkler heads may be flexible corrugated stainless steel hose with stainless steel braid, approved by both Factory Mutual and U.L. Flexible hose shall be secured above the ceiling with galvanized sheetmetal brackets and clamps. Flexible hose, brackets and clamp shall be as manufactured by Flexhead Industries, Inc. or an approved equal.

D. Underground sprinkler entrance piping shall be Class 150 ductile iron pipe with mechanical joints.

2.11 PIPE HANGERS AND SUPPORTS

A. Provide all necessary hangers, supports, bracing, accessories, etc., as required for proper installation of the work, and only approved type hangers shall be used. All sprinkler piping shall be supported from building structure; sprinkler lines under ducts shall not be supported from ductwork but shall be supported from building structure with trapeze hangers where necessary.

B. Piping supported from floors shall be provided with steel support bases.

2.12 ESCUTCHEONS

A. Each penetration through walls and ceilings shall be equipped with a chrome-plated escutcheon at the point the pipe passes through the wall or ceiling.

3.0 EXECUTION

3.01 DESIGN AND INSTALLATION

A. The design and installation of the fire suppression systems shall be based on the hazards and classes required by the occupancies indicated.

B. Underground piping shall be provided with a minimum of 3'-0" of ground cover. Concrete thrust blocks shall be provided at all changes of direction. Provide restraining rods at all mechanical joints.

3.02 FLUSHING

A. All underground lines, before connecting to the sprinkler systems, shall be flushed thoroughly in accordance with NFPA procedures.

3.03 TESTING

A. The entire sprinkler system shall be tested at not less than 200 psi for not less than 2 hours. The 300 psi sections shall be tested at not less than 300 psi for not less than 2 hours. All leaks discovered shall be repaired by tightening, replacing or re-working the leaking component or joint.

END OF SECTION

SECTION 15773

SPLIT SYSTEMS

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is governed by the Mechanical General Section 15010.

B. This Section 15773 and the accompanying drawings cover the provision of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of the split systems as specified herein and as shown. This work includes, but is not limited to, the following:

1. Split system fan coil, heating section and condensing units

2. Control system (interlocked to all split system components)

C. Split system units shall be self-contained, automatic, packaged units. These units shall be completely factory assembled as unitary packages complete with operating controls, internal wiring and piping and fully charged with R-22 refrigerant. Only one electrical power connection shall be required for each unit.

D. Units shall be UL listed and cooling capacities shall be certified in accordance with ARI 210.

1.02 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted split systems, as shown and specified, which operate efficiently and automatically, and are free of excessive noise and vibration.

1.03 BASIS OF DESIGN

A. The basis of design is Carrier. Any proposed substitutions shall be submitted in accordance with the prior approval requirements.

2.0 PRODUCTS

2.01 UNIT CASINGS

A. Unit casings shall be formed, galvanized steel construction with welded assembly. Galvanized steel surfaces shall be bonderized and painted with baked acrylic enamel for complete weather protection. Accessories and components shall match and interlock with all other split system components. Fan coil unit casings shall be fully internally insulated with liner which meets NFPA 25/50 flame spread/smoke developed ratings.

2.02 CONDENSING UNITS

A. Condensing unit refrigeration systems shall be factory charged and ready for operation. All units with capacities greater than five (5) tons shall be provided with minimum 2-stage (50% and 100%) cooling. Compressor(s) shall be direct drive, 3600 RPM, hermetic reciprocating type with centrifugal oil pump, crankcase heater and internal pressure relief valve. Compressor(s) shall have internal spring isolation and sound muffling and exhibit minimum vibration transmission and noise. Anti-recycle timers shall be provided to prevent excessive cycling of compressors thru utilization of a minimum five (5) minute time shutdown of unit on interruption of power or controlled shutdown.

B. Condensing unit condenser fans shall be direct-driven, propeller blade type. Condensing unit heat rejection shall be vertically upward.

2.03 COILS

A. Evaporator and condenser coils shall be copper tubing mechanically bonded to heavy duty aluminum fins. Aluminum tubes shall not be acceptable.

2.04 ELECTRIC HEATING SECTIONS

A. Electric heating sections shall be UL listed with nickel-chromium open coil resistance heating elements. Each heater shall be protected by an automatic reset high-limit thermostat and manual reset high-limit thermostat for the primary and secondary overcurrent/thermal protection. A proof of airflow/fan interlock shall also be provided. Controls shall provide for multiple stage start-up and operation.

2.05 CONTROLS AND ACCESSORIES

A. All operating and safety controls which are internal to each unit shall be factory installed and shall include, as a minimum, solid state compressor overload

protection, magnetic contactors, thermostatic expansion valve(s), refrigerant line drier(s), outdoor fan and compressor cycling thermostats, high and low limit protection against excessive temperatures or pressures.

B. A 24 volt transformer shall be provided to accommodate an accessory 24 volt indoor thermostat complete with an electronic programmable night setback, separate automatic heat/cool settings, auto/manual fan control and seasonal selector. Thermostat shall provide staging of the cooling and heating to match the stages of each component.

C. Provide a locking cover for each indoor thermostat.

D. Controls on electric heat section shall meet NEMA specifications and requirements.

E. Automatic shutdown controls shall be provided to meet local codes (or NFPA 90A as a minimum) and shall consist of firestats and duct-mounted smoke detectors interlocked to the fan coil unit for shutdown on the detection of fire or smoke.

2.06 FILTERS

A. Units shall have minimum 1 inch thick, low velocity, glass fiber throwaway filters in commercially available sizes.

3.0 EXECUTION

3.01 INSTALLATION

A. The split systems and associated controls shall be installed in strict accordance with the manufacturer's recommendations.

B. The control system shall be completely wired under this Division 15. Wiring shall be in accordance with the N.E.C. and shall meet all requirements for this installation.

3.02 STARTUP

A. Provide the services of a factory trained and qualified service technician employed by the unit manufacturer who shall inspect the installation including external interlock and power connections; supervise leak testing, initial operation, calibration of operating and safety controls and supervise electrical

testing including insulation resistance of motors and voltage balance between phases during starting and running.

B. This service technician shall forward a report in four (4) copies to the Owner when the unit is in safe and proper operating condition. This report shall include all pressure and control settings, meg readings, voltage readings per phase during start and run, and shall list minor discrepancies to be corrected that affect safe and reliable operation. One additional copy of the report shall be left in the unit control panel. One copy of bound installation, operation, maintenance service and parts brochures, including applicable serial numbers, full unit description and parts ordering sources, shall be placed in the unit control panel at the time of startup; four (4) additional copies shall be forwarded to the Owner.

END OF SECTION

SECTION 15774

PACKAGED ROOFTOP UNITS

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is governed by the Mechanical General Section 15010.

B. This Section 15774 and the accompanying drawings cover the provisions of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of the packaged rooftop units as specified herein and as shown. This work includes, but is not limited to, the following:

1. Packaged rooftop units including curbs and accessories

2. Control system (interlocked to the units)

C. Units shall be self-contained, rooftop curb-mounted, single package type. The rooftop units shall be completely factory assembled as a unitary package complete with operating controls and shall be completely piped, internally wired and fully charged with R-22 refrigerant. Only one electrical power connection shall be required.

1.02 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted single package rooftop units, as shown and specified which are free of excessive noise and vibration.

1.03 BASIS OF DESIGN

A. The basis of design is Carrier. Any proposed substitutions or equals by other manufacturers shall be proven equal in all respects to the equipment specified as the basis of design. Particular attention is called to the requirements of Section 15010.

B. Equal units by Trane or York are acceptable.

2.0 PRODUCTS

2.01 CURB

A. Each unit shall be provided with a full perimeter roof curb. The roof curb shall be of the same manufacturer as the unit, shall support the unit and provide a watertight enclosure to protect ductwork and utility services. Curb design shall comply with National Roofing Contractors Association requirements. Supply/return air opening gasketing shall be provided. Channel shall be provided allowing for adjustment of return air opening location to match the building structural frame indicated.

2.02 UNIT CABINETS

A. Rooftop unit cabinets shall be formed, galvanized steel construction with welded base assembly. Galvanized steel surfaces shall be bonderized and painted with baked acrylic enamel for complete weather protection. All sheet metal screws shall be stainless steel. The outside air dampers shall be low leak gasketed dampers which must match and interlock with the single package rooftop units. Cabinets shall be fully insulated.

B. Unit cabinets shall be designed for curb mounting and mate with the full perimeter roof curb for a complete weathertight seal. Unit sides shall overhang the curb to form protective drip lip.

C. Access doors for the filter section and the fan section of all units sized 20 nominal tons and larger shall be hinged, walk-in type.

2.03 COMPRESSOR SECTION

A. Compressor section refrigeration system shall be factory charged, ready for operation, providing minimum two stage cooling capacity (50% and 100%) on units of over 5 tons capacity, minimum of three stages on units of nominal 20 and 25 tons and minimum of four stages on units larger than 25 nominal tons. Compressor protection shall include high and low pressure control, outdoor ambient protection, compressor sump heat, three-phase overload protection, anticycling timer providing a minimum five (5) minute time shut down of unit on interruption of power or automatic control shutoff.

2.04 COILS

A. Evaporator and condenser coils shall be copper tubing mechanically bonded to

heavy duty aluminum fins. Aluminum tubes shall not be acceptable.

2.05 FANS

A. Fans shall be either single or double wheels, forward-curved and mounted on a common shaft with adjustable sheave drive. All fans shall be statically and dynamically balanced and tested in the factory. Fan shall not pass thru its first critical speed in order to meet the scheduled performance. Fan shaft shall be mounted on not less than two grease-lubricated ball bearings with all fan wheels mounted inboard of the bearings. The fan and motor assembly shall be mounted on a common base; on units with motor sizes larger than five (5) HP, the entire assembly shall be isolated from the rest of the unit by double deflection vibration isolators.

2.06 ELECTRIC HEATING SECTIONS

A. Electric heating sections shall be furnished with nickel-chromium open coil resistance heating elements with each element protected by an automatic reset high-limit thermostat and manual reset high- limit thermostat for the primary and secondary overcurrent/thermal protection. Controls shall provide for multiple stage start-up and operation.

2.07 CONTROLS AND ACCESSORIES

B. All operating and safety controls shall be factory installed and shall include solid state compressor overload protection, magnetic contactors, thermostatic expansion valve, refrigerant line drier and automatic damper motors.

C. A 24 volt transformer shall be provided to accommodate controls and accessories. Each unit shall be complete with an indoor thermostat and control panel complete with the following minimum list of features and capabilities:

1. Seven day programmable electronic timeclock for programming heating and cooling temperatures as well as night setback times and temperatures.
2. Battery back-up to protect the programs for up to 24 hours after a power failure.
3. Manual overrides and a failsafe program.

D. Controls on electric heat section shall meet NEMA specifications and requirements.

E. During night setback operation, morning warm-ups after night setbacks and whenever the unit is off, the outside air dampers shall be fully closed and admit no outside air.

F. Interlocks shall be made to the duct-mounted smoke detectors in each unit's supply and return ductwork to shut the unit off and fully close the return air dampers to prevent migration of smoke upon its detection.

F. Provide a factory mounted disconnect and integral duplex GFI convenience outlet on all units larger than 25 tons.

2.08 FILTERS

A. Units shall have 2-inch thick, low velocity throwaway filters in commercially available sizes. Filters shall be not less than 30%/30% average dust spot efficient when tested in accordance with ASHRAE Test Standard 52-76; Farr 30/30 or an approved equal.

2.09 AIRSIDE ECONOMIZER

A. An airside economizer shall be provided with each unit. The economizer shall be factory-assembled complete with dampers, electrical actuators, exhaust fans and all controls. The outside air dampers shall be low-leakage type.

B. The airside economizer shall provide "free" cooling whenever the outside air enthalpy is less than the set point of the outside air enthalpy sensor and cooling is required. The enthalpy sensor shall be adjustable for temperature and humidity setpoints.

C. If the cooling load is satisfied by the airside economizer alone, no mechanical refrigeration shall be initiated and the economizer dampers shall be modulated to maintain the desired discharge air temperature. The economizer shall modulate up to its full open position to meet the cooling load. When the economizer is at its maximum outside air position and further cooling is required, mechanical refrigeration shall be utilized. When the enthalpy of the outside air is above its setpoint and during normal heating cycles, the outside air damper shall be at its minimum outdoor air position.

D. Exhaust fans and staged, static-pressure controls shall be provided to prevent over-pressurization of the building during economizer mode. Units serving the first floor shall have 100% exhaust capacity. All other units shall have a minimum 50% exhaust capacity. Provide variable frequency drives on exhaust

fans in all units over 25 tons. Drives shall be controlled by a building pressure sensor.

E. The position of the return and outside air dampers shall also be controlled as specified elsewhere in response to unit and external controls.

3.0 EXECUTION

3.01 INSTALLATION

A. The packaged rooftop units and associated controls shall be installed in strict accordance with the manufacturer's recommendations.

B. The control system shall be completely wired under this Division 15. Wiring shall be in accordance with the N.E.C. and shall meet all requirements for this installation.

3.02 STARTUP

A. Provide the services of a factory trained and qualified service technician employed by the unit manufacturer who shall inspect the installation including external control interlock and electrical power connections; supervise leak testing, initial operation, calibration of operating and safety controls and supervise electrical testing including insulation resistance of motors and voltage balance between phases during starting and running.

B. This service technician shall forward a report in four (4) copies to the Owner when the unit is in safe and proper operating condition. This report shall include all pressure and control settings, meg readings, voltage readings per phase during start and run, and shall list minor discrepancies to be corrected that affect safe and reliable operation. One additional copy of the report shall be left in the unit control panel. One copy of bound installation, operation, maintenance service and parts brochures, including applicable serial numbers, full unit description and parts ordering sources, shall be placed in the unit control panel at the time of startup; four (4) additional copies shall be forwarded to the Owner.

END OF SECTION

SECTION 15800

AIR DISTRIBUTION DEVICES

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this section is governed by the Mechanical General Section 15010.

B. This Section 15800 and the accompanying drawings cover the provisions of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of air distribution devices as specified herein and as shown. These units include, but are not limited to the following:

1. Exhaust Registers (ER)
2. Fire Rated Exhaust Registers (ER-FR)
3. Exhaust Grilles (EG)
4. Supply Registers (SR)
5. Fire Rated Supply Registers (SR-FR)
6. Supply Grilles (SG)
7. Return Air Registers (RAR)
8. Fire Rated Return Air Registers (RAR-FR)

1.02 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted air distribution devices as shown and specified which are free of excessive noise, vibration and airflow fluctuations.

1.03 SELECTION CRITERIA

A. All air distribution devices shall be selected in accordance with the following minimum criteria unless otherwise noted below or on the drawings:

1. Method of mounting shall be compatible with the ceiling, wall or duct surface which it mounts on or in; i.e. lay-in, surface mounting, plaster frame, duct collar, etc. The architectural drawings shall be referenced to determine the mounting method for each device. All flanges on surface mounted devices shall be provided with a gasket.

2. Finish of all ceiling mounted devices shall be selected to match the color of the adjacent ceiling. Finish of all wall mounted devices shall be primer which is compatible with the finish coating specified for the adjacent wall; finish coat will be applied under Division 9.

1.04 BASIS OF DESIGN

A. The basis of design is Carnes. Any proposed substitutions shall be proven equal in all respects to the equipment specified as the basis of design. Any modifications to ductwork, controls, ceilings, building structure, etc., that result from any substitution shall be coordinated with all trades. This coordination shall occur before delivery of equipment and any modifications shall be performed without incurring additions to the Contract.

1.05 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers are Price, Metal Aire and Titus, provided that their units, performance, appearance and physical characteristics are equal in all respects for this specific project.

2.0 GENERAL

2.01 DESCRIPTION

A. Exhaust Registers (ER)

1. Exhaust registers shall be surface mounted, fixed curved blade steel registers with blades at 0.666 to 0.750 inches on center. Provide opposed blade dampers with each ER for balancing purposes. ERs shall be Carnes RWLA (aluminum) Carnes RTLB (steel) sized as indicated.

B. Fire Rated Exhaust Registers (ER-FR)

1. Exhaust registers shall be surface mounted, fixed curve blade steel registers with blades at 0.666 to 0.750 inches on center. Provide opposed blade dampers with each ER-FR for balancing purposes. Each ER-FR shall be Carnes RTLA sized as indicated. Each ER-FR shall be provided with a Prefco 5600 Series fire radiation damper. The ER-FR and damper assembly shall be UL R7365 certified and listed for installation in a fire-rated ceiling.

C. Exhaust Grilles (EG)

1. Exhaust grilles shall be surface mounted, fixed curved blade steel grilles with blades at 0.666 to 0.750 inches on center. EGs shall be Carnes RALA (aluminum) Carnes RSLA (steel) sized as indicated.

D. Supply Registers (SR)

1. Supply registers shall be surface mounted, steel, adjustable double-deflection type complete with opposed blade dampers for balancing purposes. The outermost set of deflection blades shall be parallel to the long dimension of the SR and the innermost set of deflection blades shall be parallel to the short dimension of the SR. The registers shall be tested in accordance with ADC standards and shall be selected to provide design airflow at a maximum NC of 35. SRs shall be Carnes RTDB Series, sized as indicated.

E. Fire Rated Supply Registers (SR-FR)

1. Supply registers shall be surface mounted, steel, adjustable double-deflection type complete with opposed blade dampers for balancing purposes. The outermost set of deflection blades shall be parallel to the long dimension of the SR and the innermost set of deflection blades shall be parallel to the short dimension of the SR. The registers shall be tested in accordance with ADC standards and shall be selected to provide design airflow at a maximum NC of 35. SRs shall be Carnes RTDB Series, sized as indicated. Each SR-FR shall be provided with a Prefco 5600 Series fire radiation damper. The SR-FR and damper assembly shall be UL R7365 certified and listed for installation in a fire rated ceiling.

F. Supply Grilles (SG)

1. Supply grilles shall be surface mounted, steel, adjustable double-deflection type. The outermost set of deflection blades shall be parallel to the long dimension of the SG and the innermost set of deflection blades shall be parallel to the short dimension of the SG. The grilles shall be tested in accordance with ADC standards and shall be selected to provide design airflow at a maximum NC of 35. SGs shall be Carnes RSDB Series, sized as indicated.

G. Return Air Registers (RAR)

1. Return air registers shall be surface mounted, steel, registers with curved hemmed edge blades with an opposed blade damper. Damper blades shall be gang operated by means of a key which can be removed after balancing. RARs shall be Carnes RTLA, sized as indicated.

H. Fire Rated Return Air Registers (RAR-FR)

1. Return air registers shall be surface mounted, steel, with curved hemmed edge blades with an opposed blade damper. Damper blades shall be gang operated by means of a key which can be removed after balancing. RARs shall be Carnes RTLA sized as indicated. Each RAR-Fr shall be provided with a Prefco 5600 Series fire radiation damper. The RAR-FR and damper assembly shall be UL R7365 certified and listed for installation in a fire rated ceiling.

3.0 EXECUTION

3.01 INSTALLATION

A. Air distribution devices shall be installed as indicated and in conformance with the manufacturer's recommendations. The color, frame and border types shall be coordinated with Architectural requirements and shall be selected to install in the finished surface indicated.

3.02 ADJUSTMENT

A. Grilles, registers and diffusers shall be tested and adjusted to provide the scheduled air flow capacities.

B. All adjustable air distribution devices located within three feet of any wall shall be set to blow directly away from, or parallel to, the wall.

C. In all slot diffuser applications, the inactive sections of the slot shall be finished with perforated steel, painted flat black, selected to match the CDs. These sections shall be open to the plenum as a return air path.

END OF SECTION

SECTION 15820

FANS

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this section is governed by the Mechanical General Section 15010.

B. This Section 15820 and the accompanying drawings cover the provision of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of the fans as specified herein and as shown. These fans include, but are not limited to the following:

1. Roof-mounted centrifugal exhaust fans

2. Ceiling/cabinet fans

1.02 INTENT

A. It is the intent of this Section of the specifications to provide complete, operable, adjusted fans as shown and specified which are free of excessive noise, vibration and airflow fluctuations.

1.03 BASIS OF DESIGN

A. The basis of design is Greenheck. Any proposed substitutions shall be proven equal in all aspects to the equipment specified as the basis of design. Particular attention is called to the requirements of Section 15010.

1.04 ACCEPTABLE SUBSTITUTE MANUFACTURERS

A. Acceptable substitute manufacturers are Carnes, Cook, Acme and Penn.

2.0 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All non-filtered fans shall be factory tested, rated and certified in accordance with the requirements of AMCA Standard No. 210 and shall be labeled

accordingly. Filtered fans may be non-labeled but must be rated in an AMCA approved laboratory in accordance with 210.

B. All roof-mounted fans shall be constructed such that water cannot enter the building through the fan regardless of whether or not the fan is operating.

C. All roof-mounted fans shall be provided complete with roof curbs. Roof curbs shall be of aluminum construction, insulated, canted and complete with wood nailer strips. Insulation shall meet NFPA 25/50 flame spread/smoke developed ratings.

D. All exhaust fans (except those utilized for grease exhaust service) shall be provided complete with gravity-type backdraft dampers.

E. All belt-drive assemblies shall be mounted on vibration isolators.

F. All motors on belt-drive assemblies shall be mounted on slide bases to provide adjustment of belt tension.

G. All belt-drives shall be rated for not less than 150% of the connected motor horsepower.

H. All belt-drives driven by a 5 HP or larger motor shall be multiple belt arrangements.

I. All belt-drives shall be adjustable to a minimum speed variation of plus or minus 20% of the design RPM.

J. All centrifugal fan wheels shall be statically and dynamically balanced.

K. All electric motors and equipment shall be UL labeled.

L. Refer to Division 16 of these specifications and to the electrical contract drawings for electrical characteristics and connections to all equipment. Coordinate all electric motors and other equipment with these electrical documents.

M. Where fan is indicated to be spark resistant, fan shall be constructed and wired of spark proof material and motor shall be explosion proof type. Motor and drive shall be located in a ventilated compartment outside the air stream.

N. All fans indicated to be coated shall be provided with factory applied heresite or

Epoxy coating. Coating shall be electrostatically or spray applied to a final coating thickness of 2.5 mil, minimum.

2.02 ROOF-MOUNTED CENTRIFUGAL EXHAUST FANS

A. Roof-mounted centrifugal exhaust fans shall be Greenheck Model G for direct drive fans and Greenheck Model GB for belt-drive fans, or an approved equal.

2.03 CEILING/CABINET EXHAUST FANS

A. Ceiling/cabinet exhaust fans shall be Greenheck Model CSP or Greenheck Model SP with integral grille, or an approved equal.

3.0 EXECUTION

3.01 INSTALLATION

A. Fans shall be installed as indicated and in conformance with the manufacturer's recommendations. Coordinate the actual units to be provided with all trades.

3.02 ADJUSTMENT

A. The fans shall be tested and adjusted after installation to provide the capacities indicated.

END OF SECTION

SECTION 15840

DUCTWORK

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is governed by the Mechanical General Section 15010.

B. This Section 15840 and the accompanying drawings cover the provisions of all labor, equipment, appliances, and materials and performing all operations in connection with the construction of the ductwork systems as specified herein and as shown. These systems include, but are not limited to, the following:

1. Supply air ductwork

2. Return, transfer and relief air ductwork

3. Exhaust ductwork

4. Outside air ductwork

1.02 INTENT

A. It is the intent of this Section of the specifications to provide a complete operable duct system as shown and specified which is reasonably airtight, free of noise, vibration and sweating, and fabricated so as to fit into the space allotted and to exhibit a minimum resistance to airflow.

1.03 DESIGN AND CONSTRUCTION

A. Ductwork shall be provided in strict accordance with the first edition - 1985 - of the SMACNA HVAC Duct Construction Standards - Metal and Flexible, NFPA No. 90A, 90B, 91 and 96, and UL 181.

B. Ductwork dimensions shown are net, clear, inside dimensions with no allowance shown for duct liner. All ductwork specified to be lined shall be 2" larger than shown in each dimension to compensate for the liner. Ductwork shall be square, rectangular, round, spiral or flat oval as noted. Conversion of duct shapes and sizes shown shall be accomplished without increasing air

velocities or friction losses and is subject to prior approval by the Architect.

C. Elbows shall be either full radius type (inside radius equal to duct width), five-gore radiused flat-oval type or, in low pressure systems only, mitered with double-thickness turning vanes.

D. Abrupt changes in duct sizes and shapes shall not be permitted. The total angle of diverging transitions shall be not more than 15 degrees; converging transitions shall be not more than 30 degrees unless otherwise noted or required due to structural constraints.

E. Offsets, transitions, rises and drops are not individually called out on the design drawings. They shall be provided as required to fit the ductwork into the allocated spaces.

F. Transition rectangular ductwork on bottom and sides. Maintain top of ductwork level and as high as possible.

G. All supply air ductwork between the VAV self-contained *** air handling **conditioning units** packaged rooftop** fan coil** unit and the terminal units shall be constructed for 3" WC static pressure class at 4000 FPM velocity with Class A seals and is herein defined as "medium-pressure" ductwork. All other ductwork shall be constructed for standard 1" WC static pressure class at 2500 FPM with Class C seals and is herein defined as "low pressure ductwork."

H. Grease exhaust ductwork joints shall be continuously welded and be liquid tight.

I. Provide the following types of ductwork material for the services indicated:

	TYPE OF MATERIAL	SERVICE
1.	Galvanized sheetmetal	Supply, return, exhaust and relief of comfort conditioned and outside air.
2.	Black Steel	Grease exhaust
3.	Stainless Steel	Dishwasher exhaust

2.0 PRODUCTS

2.01 GALVANIZED SHEETMETAL

A. Galvanized sheetmetal shall be lock-forming grade G90-ASTM A 525 hot dip galvanized steel sheets. Sheetmetal shall be galvanized on each side with not less than 1.25 ounces of zinc per square foot.

2.02 SPIRAL DUCT

A. Spiral duct shall be utilized for all flat-oval and round ductwork in medium and high-pressure systems.

B. Spiral duct shall be the product of United McGill Corporation, R.V. Money or an approved equal.

C. Spiral ribbed duct is not acceptable.

2.03 DAMPERS

A. Manual Volume Dampers

1. Single blade butterfly dampers are acceptable up to 12" round or 12" x 12" square. Dampers larger than these dimensions shall be multi-blade type. Single blade dampers shall be constructed of 16 gauge or heavier galvanized sheetmetal.

2. No multi-blade damper blade shall exceed 8" in width. All multiple blade dampers shall be constructed of 16 gauge galvanized steel or heavier. The damper frame shall be 16 gauge or heavier. The damper action shall be opposed-blade type.

3. Each blade shall pivot on a 1/2" cadmium plated, cold-rolled steel axle which pivots within self-lubricating, oilite bronze bearings.

4. The top and bottom edges of each rectangular damper blade shall be crimped for stiffness.

5. The operating rod for all dampers shall be extended outside the damper frame for attachment of an operator. Each operator shall have a position indicator and locking quadrant.

6. All dampers utilized for introduction of outside air shall have flexible, gasketed edge and end seals. The leakage rate shall be less than 4 CFM

per sq. ft. of face area against a 1" W.G. differential pressure, based on a nominal 48" x 48" damper size.

7. Manual volume dampers shall be as manufactured by Louvers & Dampers, Inc. or an approved equal.

B. Control Dampers

1. Control dampers shall be of the same construction as manual volume dampers, except that no manual operator and quadrant is required. The operating rod shall be suitable for operation by an automatic pneumatic or electric operator.

C. Fire Dampers

1. Fire dampers shall be UL-listed and labeled for 1 1/2 hours and shall be provided with 160 degrees F. links. Dampers installed within ducts shall be Type B or Type C with the blades out of the air stream. Areas indicated shall be net, clear, open areas.

D. Smoke Dampers

1. Smoke dampers shall be UL-listed as Class 1 low-leakage smoke dampers and shall be products of Prefco.

2.04 LOW-PRESSURE DUCT BRANCHES

A. Splitter dampers shall be provided at all low-pressure ductwork branches. All low-pressure ductwork branches shall be radiused or 45 degree take-offs; straight taps are unacceptable. The length of the damper blade shall be the same as the width of the widest duct section at the split, but in no case shall blade length be less than 12". Each operator rod shall have a locking swivel joint.

2.05 FLEXIBLE DUCT

A. Flexible ductwork shall be Class 1, UL 181 air duct and meet NFPA 90A and 90B Standards.

B. The internal duct surface shall be acoustically rated, black CPE bonded to a coated steel wire helix. The external jacket shall be a fiberglass, bi-directionally reinforced, metallized vapor barrier with a standing, triple ply

seam. Fiberglass insulation shall be provided between the duct surface and the jacket to achieve a maximum thermal conductance of 0.23 BTU/Hr./sq. ft./degree F. at 75 degrees F. mean.

C. Flexible ductwork shall be suitable for 10" W.G. positive pressure and 1" W.G. negative pressure.

D. Flexible ductwork, insulation and insulation cover shall be suitable for ceiling return air plenum installation and shall comply with all applicable codes and standards regarding such ceiling plenum installations.

E. Flexible duct shall be Thermalfex M-KE or an approved equal.

F. The maximum allowable installed length of flexible ductwork shall be as follows:

1. 8'-0" on low-pressure supply air systems limited to short runouts and end of runs connected to round neck supply diffusers and registers.

2. 4'-0" on medium and high-pressure supply air systems limited to the runouts from the sheetmetal ductwork to each terminal unit.

3. 2'-0" on connections from round neck grilles to sheetmetal ductwork on return, exhaust and transfer ductwork.

G. Provide a spin-in fitting with integral scoop and volume damper at all flexible run-out connections in low-pressure supply air ductwork only.

2.06 FLEXIBLE CONNECTIONS

A. Provide flexible duct connections at the inlet and outlet of each belt-driven fan, indoor unit, fan coil unit, air handling unit, etc., and at all other locations indicated. Flexible connections shall be fabricated from a glass fabric coated on both sides with neoprene. Minimum weight shall be 30 oz. per sq. yard.

2.07 DUCT HARDWARE

A. Duct hardware shall be as manufactured by Young Regulator or an approved equal.

2.08 ACCESS DOORS

A. A duct access door shall be provided at each fire damper. Access doors shall be designed for 1.5 times the pressure of the duct in which they are mounted. Access doors shall be of sufficient size to provide access to the dampers for resetting the blades and replacing the links. Access doors in medium and high-pressure ductwork shall be installed downstream of fire dampers and shall be implosion type. Where access is provided through gypsum board walls or ceilings, furnish access door for installation under Division 9. Each door shall match the fire-rating of the wall or ceiling indicated.

2.09 DUCT LINER

A. Duct liner shall be one inch thick, 1 1/2 lb. density (3 lb. density on medium- and high-pressure supply air systems) fibrous glass with one face coated with a black fire retardant compound. The permanent composite fire and smoke hazard rating of the liner shall be stenciled on the liner face and shall be:

1. Maximum flame spread 25

2. Maximum smoke developed 50

2.10 DUCT INSULATION

A. Duct insulation shall be 2" thick, minimum 3/4 lb. density fiberglass with an FSKL 0.00035" thick aluminum foil jacket, reinforced with fiberglass scrim. Thermal conductivity shall be a maximum of K = 0.24 at 75 degrees F. mean temperature.

B. Insulation adhesive shall be Benjamin Foster 85-20. Tape shall be aluminum foil and shall be SMACNA listed and labeled.

C. The composite NFPA 90A and 90B, ASTM E84, UL rating of the installed insulation shall not exceed 25/50.

3.0 EXECUTION

3.01 INSTALLATION

A. Ductwork shall be installed in strict accordance with SMACNA, UL and NFPA standards.

B. Duct liner shall be provided for the following minimum distances or through the first elbow(s) or as otherwise indicated on the drawings, whichever is

greater, downstream of each unit indicated below:

1.	Packaged rooftop unit	25 feet
2.	Air handling unit	25 feet
3.	Terminal unit	5 feet

Duct liner shall also be provided throughout all return air, transfer and plenums.

C. Duct liner shall be cut to provide overlapped and compressed longitudinal corner joints. Liner shall be installed with the coated surface facing the air stream. Duct liner shall be adhered to the ductwork with a 100% coverage of the sheet metal surfaces using a fire retardant adhesive applied by spraying. Coat all exposed leading edges and all transverse joints with fire retardant adhesive. The liner shall be additionally secured using metal pins welded to the duct and speed washers. All leading edges shall be secured with sheet metal airfoils.

D. All supply air ductwork which is not lined shall be insulated. All outside air ductwork shall be insulated. Insulation shall be cut slightly longer than circumference of duct to insure full thickness at corners. All insulation shall be applied with edges tightly banded. Insulation shall be adhered to duct with fire resistant adhesive. Adhesive shall be applied so that insulation conforms to duct surfaces uniformly and firmly. In addition to the adhesive, the insulation shall be additionally secured to the bottom of all ducts 18" or wider by means of welded pins and speed clips. The protruding end of the pins shall be cut off flush after the speed clips have been applied. The vapor-barrier facing shall be thoroughly sealed with tape where the pins have pierced through. All joints shall be sealed with 2" wide SMACNA tape. Any cuts or tears shall be sealed with SMACNA tape.

E. Flexible ducts utilized in the low-pressure ductwork systems shall be installed without kinks or bends which are less than a centerline radius equal to or greater than twice the diameter of the flexible duct being installed.

END OF SECTION

SECTION 15900

CONTROLS

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section is governed by the Mechanical General Section 15010.

B. This Section 15900 and the accompanying drawings cover the provision of all labor, equipment, appliances and materials, and performing all operations in connection with the construction and installation of the Automatic Controls as specified herein and as shown. This work includes, but is not limited to, the following:

1. Thermostats
2. Life safety shutdowns and interlock wiring
3. Relays, contactors and transformers
4. Wiring
5. Coordination with packaged equipment controls

1.02 SCOPE OF WORK

A. The scope of work includes, but is not limited to, provision of all equipment, hardware and devices for a complete system of automatic temperature control and integrated life safety functions.

1.03 AUTOMATIC LIFE SAFETY SHUTDOWNS

A. All recirculating air systems which, supply air to paths of egress (exits, corridors, lobbies, etc.) shall be provided with smoke detectors in the supply and all return air paths for automatic shutdown of that system in the event of smoke detection.

B. All recirculating air systems (rooftop units), having a design airflow capacity of 2000 CFM or greater shall have smoke detectors provided to detect the presence of smoke and automatically stop the fan(s):

1. In the return system prior to any mixing with outside air.

2. In the supply system downstream of the filters.

C. Smoke detectors shall be provided in accordance with NFPA 72E. No system shall restart until the controls are manually reset.

D. Activation of any smoke detector shall sound on audible alarm in a normally occupied area of the building.

E. Detector trouble condition shall be indicated visually or audibly in a normally occupied area of the building and shall be identified as air duct detector trouble.

F. Smoke detectors shall be interlocked with building fire alarm system.

1.04 INTENT

A. It is the intent of this Section of the specifications to provide a complete, operable, adjusted Automatic Control System as shown and specified, which is free of hunting and excessive cycling.

1.05 ACCEPTABLE MANUFACTURERS

A. Acceptable manufacturers for the automatic controls are Carrier, Trane and Johnson.

B. All automatic controls shall be installed by technicians who are either directly employed by the manufacturer or are properly trained technicians in the direct employ of an authorized dealer and installer for the manufacturer.

2.0 PRODUCTS

2.01 THERMOSTATS

A. Thermostats for split-systems units shall be as specified in Section 15773. Thermostats for packaged rooftop units shall be as specified in Section 15774.

3.0 EXECUTION

3.01 INSTALLATION

A. The controls shall be installed in strict accordance with the manufacturer's

recommendations.

B. The control system shall be completely wired under this Division 15. Wiring shall be in accordance with the N.E.C. and shall meet all requirements for this installation.

3.02 SEQUENCES OF OPERATION

A. All split systems shall be controlled as specified in Section 15773 and provided with automatic life safety shutdowns.

B. All packaged rooftop units shall be controlled as specified in Section 15774 and provided with automatic life safety shutdowns.

END OF SECTION

SECTION 16010

ELECTRICAL GENERAL

1.0 GENERAL

1.01 SCOPE

A. Division 16 includes all Specifications in the 16000 series and the accompanying Electrical Drawings. Provide all labor, materials and equipment, and all necessary operations to provide the complete scope of the electrical systems intended under this Division. Division 16 is not a stand alone document, but a part of the complete Project Documents.

B. Attention is called to the fact that there are many interfaces between the work required in this Division and the work required in other Divisions. Provide the necessary interface and coordination with other Divisions to provide a complete project.

1.02 EXISTING CONDITIONS

A. Attention is called to the fact that the work is to be performed within an existing, operational facility. Prior to the submission of bids, each bidder shall visit the project site, thoroughly investigate and be familiar with all existing conditions, which will affect their work; especially the work to be performed above the existing ceilings.

B. When this project is finished, the work under this Division shall be complete in every respect, completely integrated with all the existing systems, and left in perfect operating condition. The electrical service to the building shall not be interrupted at any time without written coordination of the building's Owner. All existing electrical equipment removed during the project shall be removed from the site after inspection of the building's Owner. All existing electrical systems required to be operating at the project's completion or required to remain in use during the project shall be reconnected, replaced, rerouted or otherwise made to fit with proper workmanship techniques and left in safe working order.

C. Connect new work to existing work in a neat and workmanlike manner. Where an existing structure must be cut or existing utilities interfere, such obstructions shall be bypassed, removed, replaced or relocated, patched and repaired. Work disturbed or damaged shall be replaced or repaired to its prior condition.

D. Prior to the start of any demolition or construction, secure the services of a qualified, EPA Certified asbestos abatement agency to check the existing insulation, etc. for asbestos. Should asbestos be found, do not proceed with demolition or construction; notify the Architect in any case in writing of the agency's findings.

1.03 CODES AND REGULATIONS

A. All work under this Division shall comply with all local building codes, laws, regulations, ordinances and the requirements of the 2005 National Electrical Code.

B. Where conflicts of installation requirements occur between the aforementioned codes, regulations or the Contract Documents, the most restrictive shall govern.

C. Obtain all permits and licenses and pay all fees required by local authorities. Arrange for all necessary inspections required by the authorities having jurisdiction and provide written certificates of approval to the project Owner or his designated representative.

1.04 DEFINITIONS

A. Contract Documents: The complete set of project Drawings and Specifications.

B. Provide: Furnish, install and connect.

C. Work: All materials installed, including all labor to provide complete system.

D. Wiring or Wired: All wire or cable installed in conduit from panelboard to equipment and connected at both ends with all required boxes, connectors, couplings, etc.

E. Conduit: Rigid steel conduit intermediate metal conduit (I.M.C.), electrical metallic tubing (EMT) plastic conduit (PVC), electrical non-metal tubing (ENT), or flexible steel conduit.

1.05 DRAWINGS AND SPECIFICATIONS

A. The Drawings and Specifications together are to be considered as the Contract Documents. Any work shown in one and not shown in the other, or implied by either, shall be provided to give a complete project.

B. Should any conflicts exist between the Drawings and Specifications or there is an item shown/called for which is not clearly defined, immediately submit a request for clarification. No additional monies will be granted later when a conflict is resolved or an item is more clearly defined.

C. The Drawings are schematic and are not intended to show the exact location outlets, etc. or the routing of conduit.

D. The exact location of equipment requiring electrical connections (mechanical equipment, theatrical lighting, etc.) shall be as located by other Divisions of the Contract Documents. Refer to the Architectural, Structural and Mechanical Documents for dimensions and details of building construction and provide work described in this Division so that it conforms to the details of the project. The right is reserved to relocate any receptacle, switch or other outlet a maximum of 10'-0" before it is permanently installed without incurring additions to the Contract amount.

1.06 SITE VISIT

A. Visit the site and become familiar with all aspects of the site and existing conditions before submitting Contract price.

B. No allowance will be made for lack of knowledge of existing conditions.

1.07 DEVIATIONS

A. No deviations from the Contract Documents shall be made without the full knowledge and written consent of the Architect.

B. If the existing conditions make it desirable to modify the Contract Documents in regard to any item, provide a written request to the Architect.

2.0 PRODUCTS

2.01 STANDARDS FOR MATERIALS AND WORKMANSHIP

A. All materials used shall be new and shall be stamped with the label of Underwriters Laboratories, Inc. (UL).

B. All materials shall meet the standards of the following associations and institutes where applicable:

1. National Fire Protection Association (NFPA)
2. American Society of Testing Materials (ASTM)
3. American National Standards Institute (ANSI)
4. National Electrical Manufacturer's Association (NEMA)
5. Institute of Electrical and Electronic Engineers (IEEE)

C. Manufacturer's names and catalog numbers specified herein are intended to describe the material and set the standard of quality. All bids shall be based on material specified. Requests for approval of material not specified shall be considered if the request is in written form and submitted to the Architect no later than fourteen (14) days before bid date. All requests shall conform with the provisions of the general and supplementary conditions.

D. Samples of materials requested to be substituted shall be furnished upon the request of the Architect.

2.02 SHOP DRAWINGS AND SUBMITTAL

A. The Engineer's review of shop drawings or submittals is a cursory review to check for general compliances of submittals with the design intent of the Contract Documents. The Engineer's review does not relieve the Contractor of his responsibility of complying with the Contract Documents. All coordination of the work in strict compliance with the Contract Documents is the sole responsibility of the Contractor.

B. The following items shall be submitted for review:

1. Conduit and wire
2. Grounding system
3. Devices
4. Coverplates
5. Metering equipment
6. Panelboards
7. Switchboard
8. Fuses
9. Overcurrent devices
10. Ground fault system
11. Disconnect switches
12. Lighting fixtures
13. Lighting control system
14. Life safety system
15. Motor starters

16. Transient Voltage Surge Suppression

C. All shop drawings and submittals shall be submitted in compliance with the requirements of the general and supplementary conditions. No more than four (4) copies of submittal data will be reviewed. Any additional copies will be returned unmarked. The responsibility of copying review comments on any additional copies will rest solely with the contractor.

D. All submittals shall bear the name of the manufacturer to be used.

E. All shop drawings and submittals shall include a stamped indication signifying that the submittal has been reviewed for compliance with the Contract Documents by the Contractor. This stamped indication also represents the fact that the Contractor has checked this submittal for its interaction with all other Divisions and certifies by his signature or initials that all coordination has taken place. The stamp shall include the date, name of the Contracting Firm, the signature of the Contractor, certification of compliance and approval. This stamp shall be on the submittal before the Engineer will review it.

F. The engineer will review an individual submittal not more than twice. If the submittal is rejected again on the second review, the contractor will bare all responsibility for paying for the engineer's time for additional reviews. Such payments to the engineer shall be withheld from the next monthly pay application.

2.03 RECORD (AS-BUILT) DRAWINGS AND MAINTENANCE MANUALS

A. At job completion, submit to the Architect, a set of prints showing all deviations from the Contract Documents. The Drawings shall also have dimensions locating all underground conduits.

B. At job completion, submit to the Architect, three (3) sets of maintenance and instruction manuals for all equipment furnished on the project.

3.0 EXECUTION

3.01 COORDINATION

A. Coordinate all space requirements with all other Divisions before installing any work. Install work such that adequate space will be allotted for all other work from other Divisions to be installed and also will allow room for future access for repair and maintenance.

B. Any work installed without proper coordination shall be relocated at the Architect's direction without increasing the Contract price.

C. During the bidding process or the pricing for a guaranteed maximum price, coordinate with all other Divisions for the total amount of work required in Division 16. Any work shown or implied in another Division requiring work in Division 16 shall be included in the Contract price regardless of whether or not it is addressed in Division 16.

3.02 PROTECTION OF MATERIALS

A. All equipment shall have the original finish when the building is turned over to the Owner.

B. Protect equipment during construction from dirt, water, chemical, mechanical damage, etc. Protect all conduit openings so that no foreign material will enter the conduit.

3.03 TESTS, DEMONSTRATION AND INSTRUCTIONS

A. Test all systems described in this Division in the presence of the Owner or a designated representative upon completion of the work. Demonstrate that the installation is in accordance with Contract Documents.

B. Any work found not to be in compliance with the Contract Documents shall be repaired or replaced without incurring any additions to the Contract price.

C. Provide to the Owner, all instruction on maintenance and operation of all systems and equipment provided under this Division. Provide all necessary tools and personnel to thoroughly present these instructions.

3.04 GUARANTEE

A. All systems, equipment, components, work, etc. provided under this Division shall be covered by a one year guarantee starting at the time of final acceptance of the work by the Owner. Any defects in the work, systems, equipment or components found during this year shall be corrected at no charge. The guarantee shall include providing all necessary cutting, patchwork, repainting, etc. to make the work complete and new.

B. Present this guarantee and any additional warranties or guarantees on furnished equipment or systems to the Architect. All equipment or system guarantees are

in addition to the general guarantee.

END OF SECTION

SECTION 16100

ELECTRICAL BASIC MATERIALS & METHODS

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 16010.

B. This Section describes the basic electrical materials and installation methods that are acceptable and applicable to Division 16.

2.0 PRODUCTS

2.01 CONDUIT

A. Galvanized rigid steel conduit shall be low carbon, hot-dipped galvanized both inside and out with threaded joints.

B. Intermediate metal conduit (IMC) shall be steel, galvanized both inside and out with threaded joints.

C. Electrical metallic tubing (EMT) shall be steel, galvanized both inside and out.

D. Plastic conduit (PVC) shall be schedule 40 PVC heavy wall type. A grounding conductor shall be provided.

Electrical non-metallic tubing (ENT) shall be of such material that it is resistant to moisture, chemical atmospheres and is flame retardant. A grounding electrode conductor shall be provided.

E. Flexible metal conduit shall be flexible steel conduit tubing and shall meet Underwriters Laboratories Standard for Flexible Steel Conduit.

F. Liquid-tight flexible metal conduit and liquid-tight non-metallic conduits shall be liquid-tight and sunlight resistant.

G. Steel conduit approved manufacturers are Allied, Triangle and Republic.

H. PVC and ENT conduit approved manufacturers are Carlon and Triangle.

2.02 CONDUIT FITTINGS

A. Rigid conduit and IMC conduit fittings shall be zinc-coated, ferrous metal and taper threaded type.

B. EMT fittings shall be zinc-coated steel and hexnut compression or set-screw type. EMT connectors shall have insulated throats.

C. PVC fittings, elbows and cement shall be produced by the same manufacturer. All joints shall be solvent welded in accordance with the manufacturer's recommendations.

D. Conduit connections to switchboards, motor control centers, transformers, panel cabinets, and pull boxes shall have grounding wedge lugs between the bushing and the box or locknuts designed to bite into the metal.

E. Each conduit end shall be provided with either an insulated throat connector or separate locknut and insulated bushing. Bushing shall be installed before any wire is pulled.

F. Conduit fittings approved manufacturers are Raco, Steel City, O.Z. Gedney, Thomas & Betts and Appleton.

G. Expansion fittings shall be provided in all conduit which crosses and expansion joint.

2.03 CONDUCTORS

A. Conductors shall be copper of 98% conductivity, 600 volt insulation. Sizes specified are AWG gauge for No. 4/0 and smaller and circular mils (MCM) for all sizes larger than no. 4/0. Conductors No. 10 and smaller shall be solid and type "THHN" or "THWN" insulation. No. 8 and larger shall be stranded and type "THW" or "XHHW" insulation. Aluminum conductors may be used for service lateral conductor if the same or larger capacity of the conductors specified. Aluminum conductors shall be Alcan 8000 series, Stabiloy or approved equal.

2.04 OUTLETS

A. Outlet boxes and covers shall be of such form and dimensions as to be adapted to their specified usage, locations, size and quantity of conduit, and size and quantity of conductors entering the boxes. In special "Fire Rated" partitions,

outlets shall comply with ASTM No. E119.

B. Flush ceiling outlets for surface or pendant mounted lighting fixtures shall be one-piece 4" square or octagonal pressed steel boxes. Boxes for devices in unfinished masonry walls or stud walls shall be pressed steel, square corner, sectional switch boxes, or shall be 4" square box with a square cornered tile wall cover, set flush with masonry construction. Boxes in concrete ceiling slab shall be octagonal, shallow concrete boxes. Welded boxes are not acceptable.

C. All outlet boxes in plaster or masonry walls or ceiling shall be provided with plaster rings.

D. Junction boxes and all outlets not indicated as containing wiring devices or lighting fixtures shall have covers. Covers for outlets in walls shall be as specified for wall switches and receptacles.

E. Outlet boxes exposed to the weather and outlet boxes for vaportight lighting fixtures and devices shall be of cast iron corrosion resistant type.

F. Outlet box approved manufacturers are Appleton, Raco, Steel City or Crouse-Hinds.

2.05 DISCONNECT SWITCHES

A. Disconnect switches shall be "heavy-duty" type, enclosed switches of quick-make, quick-break construction. Switches shall be horsepower rated for 600 volts AC as required. Lugs shall be UL listed for copper and aluminum.

B. Padlocking provisions shall be provided for padlocking in the OFF position.

C. Switches shall be furnished in NEMA I General purpose enclosure unless noted otherwise. Switches located on the exterior of the building or in "wet" locations shall have NEMA 3R enclosures.

D. Fused disconnect switches shall have rejection type fuse clips with dual element, current limiting fuses of rating shown.

E. Disconnect switches shall be mounted to structure. Disconnect switches shall not be mounted to mechanical equipment or ductwork.

2.06 NAMEPLATES

A. Nameplates shall have 3/8" high engraved letters.

B. 120 or 208 volts: white core laminated bakelite with black finish.

2.07 WALL SWITCHES

A. Wall switches shall be plastic, totally enclosed, quiet type, self-grounding, 120 volts and 20A rating and shall match existing if possible and equal the following:

Single Pole: Hubbell No. CS1221, or equal by Leviton, P&S or Cooper.

Double Pole: Hubbell No. CS1222, or equal by Leviton, P&S or Cooper.

Three-Way: Hubbell No. CS1223, or equal by Leviton, P&S or Cooper.

Four-Way: Hubbell No. CS1224, or equal by Leviton, P&S or Cooper.

B. Color shall be as selected by architect.

C. Flush motor switches with red pilot light and with overload protection for fractional horsepower motors shall be Hubbell No. HBL1221PL.

D. Key switches shall be Hubbell No. HBL1221L 20A Series or approved equal by P&S or Leviton.

2.08 WALL MOUNTED OCCUPANCY SWITCHES

A. The passive infrared sensor shall be a completely self-contained control system that replaces a standard toggle switch. Sensor shall have ground wire for safety. Switching mechanism shall be a latching air gap relay, compatible with electronic ballasts, compact fluorescent, and inductive loads. Triac and other harmonic generating devices shall not be allowed.

B. Sensor shall cover up to 1000 sq. ft. for walking motion, with a field of view of 180 degrees.

C. Sensor shall have system which provides superior 180 degree coverage.

D. Sensor shall operate at 120 VAC or 277 VAC.

E. Sensor shall have no minimum load requirement and shall be capable of

switching from 0 to 500 watt incandescent; 0 to 800 watts fluorescent or 1/6 hp @ 120 VAC, 60 Hz; and 0 to 1200 watts fluorescent or 1/3 hp @ 277 VAC, 60 Hz.

F. For accuracy and consistency, sensor shall have a DIP switch controlled, digital time delay adjustable from 15 seconds to 30 minutes.

G. Sensor shall have standard 5 year warranty and shall be UL and CUL listed.

H. Sensor shall be Wattstopper WI Series, Leviton Decora Series or approved equal by engineer.

2.09 RECEPTACLES

A. Duplex receptacles shall be plastic, two-pole, three wire, self-grounding, side wired, 125 volts and 15A rating and shall match existing if possible and be equal to the following: Duplex receptacles shall be Hubbell No. CR5262 Series, or equal by Leviton, P&S or Cooper. Isolated ground type shall be Hubbell No. CR5252IG Series, or equal by Leviton, P&S or Cooper.

B. Single receptacles shall be two-pole, three wire, self-grounding, side wired, 125 volts and 20A rating and shall be equal to the following: Single receptacles shall be Hubbell No. HBL5361 Series, or equal by Leviton, P&S or Cooper. Isolated ground type to be Hubbell No. IG-5361 Series, or equal by Leviton, P&S or Cooper.

C. Ground fault circuit interrupt (GFI) receptacles shall be Hubbell GFR5352, or equal by P&S, Leviton or Cooper.

D. Color shall be as selected by the Architect.

2.10 COVERPLATES

A. Coverplates for flush mounted devices shall be brushed finished stainless steel standard size, Hubbell "P" Series or equal by Leviton, P&S or Cooper.

B. Telephone outlet coverplates shall have same finish as above and have a bushed hole in the center.

C. Coverplates for exterior devices shall be self-closing, die cast aluminum Hubbell WP8M or equal by Leviton, P&S or Cooper.

2.11 PLYWOOD BACKBOARDS

A. Provide plywood backboards where shown. Backboards shall be minimum 3/4" thick and sized as shown or to accommodate equipment indicated to be mounted thereon.

B. Secure plywood to the building structure and paint with two coats of gray paint.

2.12 SMOKE AND FIRE STOP FITTINGS

A. Smoke and Fire Stop Fittings shall be UL listed for that purpose. The fittings used to seal conduit either on the outside of the conduit, busway or cable or internally shall have heat activated intumescent material, which expands to fill all voids. Smoke and fire stop fittings shall be O.Z./Gedney "FIRE-SEAL" or Dow Corning silicone RTV foam with an hourly fire-rating equal to or higher than the rating of the floor, ceiling or wall through which the cable or conduit passes. The seals for conduit shall be of the flanged type.

2.13 FUSES

A. Provide all fuses. All fuses shall be of the same manufacturer. All fuses shall be of the high interrupting rating (200,000 Amps), current limiting type and manufactured by Bussmann. Fuses shall be provided for each fuse cutout and the specified quantity of fuses shall be furnished for spares.

B. Circuits 0 to 600 ampere shall be protected by rejection type, current limiting BUSSMANN LOWPEAK Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). All dual-element fuses shall have separate overload and short-circuit clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class RK-1.

C. Circuits 601 to 6000 ampere shall be protected by current limiting BUSSMANN HI-CAP Time-Delay Fuses KRP-C. Fuses shall employ "O" rings as positive seals between the end bells and the glass melamine fuse barrel. The terminals shall be opened. Fuses shall be time-delay and must hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in 0.1 seconds or less and be listed by Underwriter's Laboratories, Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class L.

D. Furnish and turn over to the Owner a minimum of one (1) set of spare fuses (set consisting of three fuses) for each type and rating of fuse used. When the number of fuse sets of the same type and rating actually installed exceeds five (5) sets, furnish an additional spare set of fuses for each five (5) or fraction thereof.

E. Provide a cabinet in which to store all spare fuses, Bussman Catalog No. SFC

F. Acceptable manufacturers are Bussman or equal by Littlefuse.

3.0 EXECUTION

3.01 CONDUIT

A. Rigid steel (or IMC) shall be used for service entrance and all feeders and branch circuits where exposed to damage.

B. EMT shall be used for branch circuits, fire alarm and telephone when not underground or in concrete in contact with the earth.

C. Schedule 40 PVC may be used for all underground feeders, service entrance conductors when encased in 4" of concrete on all sides, or under the lowest floor slab.

ENT may be used for branch circuits in concealed areas which is not used as an environmental air plenum.

D. Conduit shall be continuous from outlet to outlet, from outlet to cabinet, junction box and pull box. Conduit shall enter and be secured to all boxes, etc., in such a manner that each system will be electrically continuous from service to all outlets such that a good ground is provided. All conduit from cabinets and junction boxes shall terminate in approved outlet boxes or conduit fittings. Conduit connections to any box which has no threaded hub shall be double locknutted.

E. Provide junction boxes or pull boxes where shown and where necessary to avoid excessive runs or too many bends between outlets. The conduit sizes shown may increase if desired to facilitate the pulling of cables.

F. All conduit shall be concealed unless indicated otherwise. Install exposed conduit parallel with or at right angles to the building walls and support from walls or ceilings at intervals required by Code with approved galvanized iron

clamps or hangers. Concealed conduit above the ceiling shall be supported independent of ceiling construction. Where ceilings of lay-in type are used, conduit must be installed high enough to permit removal of ceiling panels and lighting fixtures. Use threaded rods and hangers for supporting single conduit. Use trapeze hangers consisting of double-nutted threaded rods and "Unistrut" channels or angles of 12 gauge minimum steel for supporting multiple conduit.

G. Minimum size conduit for branch circuits shall not be smaller than 1/2". Home runs shall extend from outlets shown to panel designated. Home runs shown shall not be combined. Home run conduit shall not be smaller than 3/4".

H. At couplings, conduit ends shall be threaded so that they meet in the coupling. Right and left hand couplings shall not be used; conduit couplings of the Erikson Type shall be used at locations requiring such joints.

I. All conduit for future use, for telephone wire, or for data communication cable, shall be left with No. 16 gauge wire pulled in them or a pull line as manufactured by Ideal, and the ends securely corked or capped.

J. Expansion fittings shall be installed in all conduit which pass through the cross-sectional area of expansion joints.

K. Provide non-hardening elastic type duct seal compound, Neer No. DC., 3M Co. "Scotchfil", or Gardner Bender duct seal, for each conduit entering the building from outside and for each conduit passing from one space into another which is normally at a lower temperature.

L. Provide watertight conduit hubs on conduit terminating in a box or cabinet exposed to the weather.

M. Space in sleeves or around conduit that pass through fire resistive or fire rated walls, partitions, floors or ceilings shall be closed by packing with an unlabelled fire resistive material that will maintain the rating of the barrier penetrated.

3.02 FLEXIBLE CONDUIT

A. PVC extruded cover flexible conduit shall be used in making short flexible connections to rotating or vibrating machinery or equipment. The flexible conduit at these locations shall be as short as possible, but shall have a minimum length of 12".

B. A green stranded bonding jumper shall be installed outside of all flexible conduit that extends directly from a non-flex conduit to a rotating or vibrating machine. Where a junction box is used, the green stranded bonding jumper shall be installed inside the flexible conduit and attached to the junction box and to the machine. When the bonding jumper is installed outside of the flexible conduit, plastic wire straps shall be used 6" o.c. to secure the jumper to the flexible conduit.

C. Flexible metal (MC) conduit system may be utilized where concealed in walls and/or millwork only. MC Cable shall run from point of exit from wall or millwork to nearest structurally support junction box. MC cable will not be permitted to be installed in the above ceiling space and shall not pass through a fire rated partition. Conductor colors of the MC cable shall comply with 16100 3.04 D.

1. MC cable shall be constructed to have an insulated, copper ground conductor. Sheathing with a bare aluminum conductor shall not be used as the ground.

3.03 CONDUIT PROTECTION

A. All conduit installed in the ground outside the building exterior line (with the exception of exterior lighting circuits) shall be encased in 4" of concrete on all sides. Concrete shall be a minimum of 3000 P.S.I. mix. All threaded joints in rigid conduit that is encased in concrete shall have a U.L. listed joint compound applied. All conduit installed outside the building underground shall be buried a minimum of 30" below finished grade but in no case shall be buried deeper than 48". Where conduit is installed below the ground floor slab inside the building exterior line, the conduit shall be run between the floor slab and the vapor barrier. These conduits shall be installed in the slab itself where feasible. When a conduit duct bank must be installed then the entire duct bank shall be encased in concrete and installed per Appendix B of the NEC. Derating of conductors in the underslab duct bank shall be the responsibility of the contractor. Conduit installed in any slab, where permitted above, shall be above the bottom steel and below the top steel.

B. Conduit shall be secured in place and protected where necessary to prevent damage to work during construction. The ends of all conduit shall be plugged to avoid filling with any foreign matter. All conduit shall be blown out and swabbed clear of water and trash prior to pulling wire.

C. Provide identifying marker tape the entire length of each conduit installed in the

ground outside the building. The tape shall be constructed of inert polyethylene, resistant to acids, alkalis, etc., in the soil, and shall be a minimum 4 mil thickness. The tape shall be yellow, 6" wide, and shall have the words, "CAUTION - ELECTRIC LINE BURIED BELOW," imprinted with contrasting permanent ink. The imprint shall repeat itself for the entire length of the tape. The tape shall be buried at a maximum of 18" below finished grade, above a portion of the earth fill shall be "Terra Tape" as manufactured by Reef Industries, Inc., P.O. Box 33248, Houston, Texas 77033 (1-800-231-6074).

3.04 WIRING

A. All conductors shall be installed in conduit. No conductors shall be pulled into the conduit until the conduit system is complete and plaster had dried. Wire pulling lubricants shall be Gardner-Bender "Wireaide" or Ideal "Yellow 77".

B. Conductors shall be continuous from outlet to outlet and from outlet to junction box or pull box. All splices and joints shall be carefully and securely made to be mechanically and electrically solid with pressure type connectors, Gardner Bender "Winggard" or Ideal "Wingnut". Tape shall be "Scotch" No. 33 for indoor and No. 88 for outdoor or Gardner Bender No. 95-661. Where connection is made to any terminals of more than 30 amperes capacity and where conductors larger than No. 10 are connected to any terminal, copper terminal lugs shall be bolted to the conductors. Where multiple connections are made to the same terminal, individual lugs for each conductor shall be used. Aluminum conductors, if used for service conductors, shall be made with high compression lugs as manufactured by Square D, Ideal or MAC.

C. Each conduit shall have a minimum of two (2) conductors pulled in unless that particular conduit is noted as being for systems other than electrical circuitry and/or future use or unless noted otherwise.

D. Conductors for lighting and receptacle circuits shall have color coded jackets. The wiring shall be color coded with the same color used with its respective phase through the entire job as follows:

208/120 Volt System

Phase A - Black
Phase B - Red
Phase C - Blue
Neutral - White

Ground - Green

E. The feeder and service entrance conductors shall be color coded by the use of colored plastic tape applied within 6" of each conductor end.

F. Branch circuit conductors shall not be smaller than No. 12 and where the home run from center of load exceeds 100'-0", the conductors from home run outlet to panel shall be No. 10 minimum.

G. For branch circuits terminating in outlet without device, leave minimum of 12" of slack wire coiled for connection of equipment. All conductors shall be identified with proper circuit numbers at terminals, junction boxes at panelboards within 6" of conductor ends.

3.05 OUTLETS

A. Provide galvanized steel or cast type boxes for all outlets.

B. Where outlet boxes are used to support lighting fixtures, the outlet box shall be anchored to the structural members of the building per NEC 370-13.

C. Outlet boxes shall be flush mounted unless they are specifically shown as being used with exposed conduit or are located above a ceiling.

D. Where outlets are supplied from conduit run in or below floor slabs, the conduit shall be stubbed up at the location shown and the wall built up around the conduit.

E. Cuts for outlet boxes in masonry walls shall be made so that the coverplate will completely cover the cut. The mounting height of switch, receptacle and other outlets may be varied slightly, with the Architects approvals, so that the outlet box, top or bottom, will occur at a masonry joint.

F. The edge of all outlet boxes shall be flush with the surface in which they are recessed. The devices that fit into the outlet boxes shall be screwed tight before the coverplate is installed and the coverplate shall not be used as a means of tightening the devices in place.

G. Where outlets are shown as being adjacent and different mounting heights are specified for each, they shall be mounted one directly over the other, on the centerline of the group.

3.06 NAMEPLATES

A. Provide specified nameplates on the main switchboard, distribution panels, feeder switches, feeder breakers, panelboards motor control centers, disconnect switches, contactors, starters, transformers, start-stop push buttons and motor switches.

B. Provide nameplates on every device in the main switchboard, distribution panels and motor control centers.

C. Nameplates for surface mounted equipment shall be installed on the exterior of equipment with sheetmetal screws. Nameplates for flush or recessed mounted equipment shall be installed on the inside of the panel door or cover with epoxy cement.

3.07 WALL SWITCHES AND RECEPTACLES

A. Where more than one device is indicated at a location, the devices shall be gang-mounted in combined multi-gang boxes and covered jointly by a common coverplate. Provide barriers as required by the devices and voltages being used.

3.08 COVERPLATES

A. All junction boxes, outlet boxes, multi-gang switch boxes, utility boxes, etc., shall be covered with a coverplate. The coverplate shall be a finished plate as specified unless designated otherwise.

B. Coverplates shall be mounted vertically unless designated otherwise.

3.09 GROUNDING

A. Ground connections shall be in accordance with the 2005 National Electrical Code.

1. Provide a grounding electrode system consisting of a minimum of three (3) copperweld rods, 3/4" x 10'-0", driven 24" below grade a minimum of 72" apart in the form of an equilateral triangle, bonded together with No. 4/0 conductors. Install rods a minimum of 36" clear of foundation walls to effect the building ground. If the resistance to ground exceeds 25 ohms, additional rods shall be driven and bonded together until a reading of 25 ohms or less to ground is obtained. After completion of the grounding system, measure the system ground resistance with a

"Megger Earth Tester". Submit directly to the Architect two (2) copies of each test report certified by the testing technician and the Owner's representative.

2. Extend from the electrodes to the main service disconnect with a No. 4/0 copper insulated ground conductor in a 1" conduit and connect to the neutral bar, housing and frame.

3. Provide a No. 4/0 copper insulated conductor across the water meter with the conductor attached with clamps to the water line on each side of the meter.

4. Provide a No. 4/0 copper insulated ground conductor in a 1" conduit from cold water entrance pipe ahead of first valve to the main service disconnect and connect to the neutral bar, housing and frame.

5. Where nonmetallic insulating couplings or dielectric flanges are used in metallic water piping systems, provide a No. 4/0 copper, insulated ground conductor across the couplings with the conductor attached with clamps to the water line on each side of the coupling.

6. All ground connections in the building system ground shall be done with Cadweld.

7. All ground clamps shall be equipped with compression type cable lugs independent of the compression device clamping the pipe or rod.

8. All steel conduit entering the main service disconnect shall have threaded conduit insulated grounding bushings. All bushings shall be bonded together and bonded to the main grounding bus with a No. 4 bare conductor.

B. Provide an insulated green bonding jumper from the grounding lug of all receptacles to a Steel City "GEE" clip or a sheet metal screw in the outlet box. The ground wire installed behind the device mounting screws will not be acceptable.

C. Provide 1 #6 AWG ground in 3/4" conduit from the system ground to the telephone company main distribution frame or service cabinet and to each telephone backboard.

3.10 TELEPHONE CONDUIT SYSTEM

A. Telephone service shall include plywood backboards and equipment cabinets with service entrance conduit as shown.

B. Telephone service entrance cable, all branch cabling and telephone instruments shall be provided by the telephone equipment vendor.

C. Provide an outlet and conduit system for the telephones as shown and leave the same in readiness for wiring by others. Provide pull line in all telephone conduit. Terminate all conduit at a uniform height with smooth insulated bushings at the telephone plywood backboards.

D. Telephone wall outlets shall be pressed steel sectional switch boxes, wall mounted at the locations indicated. Coverplate shall have a bushed hole.

E. Telephone floor outlets shall be floor boxes as specified at the locations indicated.

3.11 CONNECTION TO EQUIPMENT

A. Equipment furnished by the Owner or under other Sections, such as mechanical equipment, elevators, escalators, signs, kitchen equipment, etc., will be installed by others. Provide electrical service and make the electrical circuit connection to this equipment.

B. Provide PVC insulated flexible cord sets for all cord and plug connected building appliances and equipment. Cords shall be sized in accordance with electrical circuits indicated. Multiple conductor cords shall be "SO" cable with PVC jacket and green insulated ground conductor.

3.12 CORING, CUTTING AND PATCHING

A. Set sleeves for conduit accurately before the concrete floors are poured, or set boxes on the forms so as to leave openings in the floors in which the required sleeves can be subsequently located. Fill in the voids around the sleeves with concrete.

B. Should the performance of this preliminary work be neglected and should cutting be required in order to install conduit, then the expense of the cutting and restoring of surfaces to their original conditions shall be accomplished without incurring additions to the Contract.

3.13 EQUIPMENT ANCHORING

A. All items of electrical equipment, such as switchboards, motor control centers, transformers, standby generator, etc., shall be securely anchored to the building structure. The anchoring shall be accomplished by utilizing a minimum size of 3/8" steel anchor bolts in the structure and to the item of equipment. A minimum of two (2) anchor bolts shall be provided on each side of each item of equipment with the following exceptions:

Exception No. 1: If the equipment manufacturer includes more than two (2) anchor holes per side in the base or base frame of the equipment item, then there shall be one anchor for each anchor hole.

Exception No. 2: If the equipment manufacturer recommends a particular quantity greater than two (2) per side, then that quantity of anchors shall be provided.

END OF SECTION

SECTION 16200

SERVICE AND DISTRIBUTION

1.0 GENERAL

1.01 DESCRIPTION

A. All work specified in this Section shall comply with the provisions of Section 16010.

B. Provide a complete electrical distribution system. The system shall include the service entrance, main switchboard, service wire gutter, feeders, distribution panels, panelboards, remote control switches, contactors, etc., to provide a complete system.

C. All distribution switchgear (branch circuit panelboards, switchboard, distribution panelboards, etc.) shall be the unit responsibility of one manufacturer. All component parts of the above listed items shall be of the same manufacturer except where a written request for deviation from this requirement has been approved prior to bid date.

D. Shop drawings for equipment specified in this Section shall show that all specified requirements have been incorporated.

E. All floor mounted distribution equipment shall be mounted on a 4" high concrete pad.

1.02 ELECTRICAL SERVICE

A. Make all arrangements with the power company and pay all charges made by the power company for permanent electric service. In the event that the power company's charges are not available at the time the project is bid, the bids shall be qualified to notify the Owner that such charges are not included.

B. The power company will provide the underground primary service and the pad mounted transformer.

C. Provide the pad for the pad-mounted transformer in accordance with the power company specification.

D. The secondary service to the building shall be 120/208 volts, 3-phase, 4-wire, 60

Hertz AC. Provide all conduit and wire as specified from the secondary terminals of the transformer to the main switchboard.

E. Each tenant will be responsible for sizing (based on service demand), installing service equipment and extending the Landlord's conduit from the electrical wire gutter into the premises.

F. The electrical service for retail lease areas is sized to accommodate a nominal electrical installation of 25 Watts per square foot. Loads in excess of this allowance will require special review and written permission of the building management. Any required revisions to the shell building electrical distribution system to accommodate the increased electrical load will be by the Tenant.

G. The electrical services for restaurant lease areas is sized to accommodate a nominal load of 50 Watts per square foot. Loads in excess of this allowance will require special review and written permission of the building management. Any required revisions to the shell building electrical distribution system to accommodate the increased electrical load will be by the Tenant.

1.01 METERING

A. Metering equipment will be by the power company. The power company will furnish the meter cabinet(s) for installation at a location as directed by the power company and as detailed at the pad-mounted transformer.

B. Provide a 1" conduit from the transformer to the meter cabinet. The power company will provide the control wires to the meter.

C. Each individual tenant will be responsible for arranging service with the power company and installing service related equipment.

2.0 PRODUCTS

2.01 BRANCH CIRCUIT PANELBOARDS

A. Panelboards (panels) shall be general purpose enclosures and shall be surface or flush mounted as indicated. Panels shall be of the automatic circuit breaker type, factory assembled by the manufacturer of the circuit breakers. Panels shall be for the voltage indicated with the quantity of poles and ampacity of circuit breakers shown.

B. Boxes and trim shall be made from code gauge steel. Boxes shall be sufficient

size to provide a minimum gutter space of 4" on all sides. Boxes shall be minimum 20" width and 5 3/4" depth.

C. Hinged door covering all device handles shall be included in all panel trim. Doors shall have flush-type cylinder lock and catch, except that doors over 48" in height shall have auxiliary fasteners at top and bottom of door in addition to flush-type cylinder lock and catch. Door hinges shall be concealed. All locks shall be keyed alike. Directory frame and card having a transparent cover shall be furnished each panel door.

D. Trims for flush panels shall overlap the box by at least 3/4" all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver without the need for special tools. After installation, trim mounting mechanism or hardware shall not be accessible when panel door is closed and locked.

E. All exterior and interior steel surfaces of the trim shall be cleaned and finished with gray paint over a rust-inhibiting phosphatized coating.

F. All interiors shall be completely factory assembled with protective devices, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire.

G. Interiors shall be so designed that devices can be replaced without disturbing adjacent units and without removing the main bus connectors, and shall be so designed that devices may be changed without machining, drilling or tapping.

H. Bus bars for the mains shall be of copper sized in accordance with U.L. standards. Full size bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices.

I. Phase bussing shall be full height without reduction. Cross and center connectors shall be of the same material as the bus.

J. The neutral bus shall utilize setscrews to bond the neutral wire to the neutral bus through holes drilled in the neutral bar. A sheet copper neutral bus utilizing flathead screws to hold the neutral wires will not be acceptable.

K. Spaces for future devices shall be included as indicated and shall be bussed for the maximum rated device that can be fitted into them.

L. All circuit breakers shall be manually operated, thermal-magnetic, automatic, of

the ampacity and poles as indicated. They shall be quick-make, quick-break, both on manual and automatic operation. Breakers shall be over-the-center toggle operating type, with the handle going to a position between ON and OFF to indicate automatic tripping. All multi-pole breakers shall have internal common trip. Breakers shall have a minimum of 10,000 RMS symmetrical amperes interrupting capacity unless designated otherwise. The breakers furnished shall be determined by the specifications and by the minimum U.L. labeled RMS symmetrical amperes interrupting capacity at circuit voltage. All circuit breakers shall be bolted on and rigidly braced.

M. Panels having sub-feed lugs for feeding through shall have 8" minimum extra gutter space at the lug end and on one side.

N. Each panel as a complete unit shall have a short-circuit current rating equal to or greater than the equipment rating indicated.

O. Panels shall be as manufactured by General Electric, Square D, or Cutler-Hammer.

2.02 DISTRIBUTION PANELBOARDS

A. Distribution panelboards (panels) shall be of the circuit breaker type, factory assembled by the manufacturer of the circuit breakers, complete with front door cover. The main breaker and the branch circuit breakers shall be as indicated. The main bus shall be 98% conductivity silver plated copper, rated as and of capacity equal to or greater than the rating or setting of the over-current protective device next back in the line. Panel shall be suitable for the voltage and phase indicated. Provide 25% ground bus.

B. Panels shall be flush or surface mounted as indicated, with baked-on enamel trim, adjustable trim clamps and door with chromium plated combination cylinder lock and catch, all locks keyed alike. Provide a specified nameplate for each device and a blank (not engraved) nameplate for each spare breaker or space.

C. The neutral bus shall utilize setscrews to bond the neutral bus through holes drilled in the neutral bar. A sheet copper neutral bus utilizing flathead screws to hold the neutral wires will not be acceptable.

D. All circuit breakers shall be manually operated, thermal-magnetic, automatic, of the ampacity and poles as indicated. They shall be quick-make, quick-break both on manual and on automatic operation. Breakers shall be over-the-center toggle operating type, with the handle going to a position between "ON" and "OFF" to

indicate automatic tripping. All multi-pole breakers shall have internal common trip.

E. The interrupting capacity of the breakers furnished shall be 10,000 RMS symmetrical unless indicated otherwise.

F. All main circuit breakers shall be molded case and vertically mounted. All vertically mounted molded case circuit breakers shall be mounted so that the handle is up for "ON" and down for "OFF", when viewed from the normal standing position. All vertically mounted molded case main circuit breakers shall be UL approved for feeding in the bottom and out the top.

G. All circuit breakers, including any connectors to the main bus, shall be bolted and rigidly braced.

H. Spaces for future installation of molded case circuit breakers are specifically by range of trip rather than a single trip size or frame size. The spaces so scheduled shall be complete with all bus and required bus connectors such that future breakers can be installed without adding or changing bus connectors on the main bus and without using a larger (frame size) or more expensive breaker than the trip size and interrupting capacity would require. If the bus connectors furnished on the main bus will not cover the trip range specified, then duplicate sets of connectors shall be furnished on the main bus for each frame size required.

I. Distribution panels shall be as manufactured by General Electric, Square D, or Cutler-Hammer.

2.03 MAIN SWITCHBOARD

A. General

1. Provide where indicated, a front and rear accessible dead front type, completely metal enclosed, self-supporting structure independent of wall supports. It shall consist of the required number of vertical sections bolted together to form one rigid switchboard approximately 90" high incorporating switching and protective devices of the number, ratings and type noted herein or shown with necessary interconnections, instrumentation and control wiring. The sides, top and rear shall be covered with removable screw-on plates. Front plates shall be sectionalized and removable. All covers shall be secured by self-tapping screws. Ventilation openings shall be provided where required. The switchboard shall be vermin proof.

2. All sections of the switchboard shall be 20 inches deep except service sections containing large ampacity main circuit breaker or pressure contact type main fusable switch which may be deeper. All section of the switchboard shall align so that the back of the complete structure may be placed flush against a wall. Construction shall allow maintenance of incoming line terminations, main device connections and all main bus bolted connections to be performed with front and rear access.

3. The feeder or branch devices shall be removable from the front and shall be panel mounted with the necessary device line and load connections front accessible.

4. All exterior and interior steel surfaces of the switchboard shall be cleaned and finished with gray hard dried enamel over a rust-inhibiting phosphatized coating.

5. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished when required. All groups of control wires leaving the switchboard shall be provided with terminal blocks with numbering strips.

B. Bussing

1. The bus shall be tin plated aluminum or silver plated copper adequately braced and supported to withstand mechanical forces exerted during short circuit conditions. The main horizontal bus bars shall be mounted on glass polyester insulators with all three phases arranged in the same vertical plane. The main bus shall be braced for short circuits up to the RMS ampere value as shown.

2. A ground bus shall be provided firmly secured to each vertical structure and shall extend the entire length of the switchboard. A ground lug shall be furnished attached to the ground bus in an accessible location.

3. Provide a removable link (solid bar) in the neutral bus where the main disconnect device is provided.

4. Provide a bonding strap from the neutral bus to the switchboard frame. The bonding strap shall be located on the line side of the removable neutral link.

C. Fusible Switches

1. The main service entrance disconnect device and other protective devices shall be fusible switches as scheduled. The switches shall be NEMA 1 construction and shall have provisions with clear indications that the device is in "ON" or "OFF". The switches shall be quick-make, quick-break mechanisms with a defeatable door interlock to prevent door from being opened when the operating handle is in the "ON" position.

2. Switches shall be operated by a lever-type handle extending through a door with provisions for padlocking in the closed position.

3. Switches of 30-600 amperes shall have plug-on line side connections. Switches of 30-100 amperes shall have built-in fuse pullers. Switches shall have a 200,000 ampere short-circuit rating. Switch enclosures shall have formed openings for maximum protection of load side cables.

4. Switches 800 amperes and larger shall be of the bolted pressure contact type with rating as shown. Pressure contacts are to be made by firmly bolting blades to both top and bottom stationary contacts. Switches shall have quick-make, quick break Kinematic-action mechanisms, interphase barriers and arcing equipment. Switches shall be manually operated and have an electric trip mechanism piloted by the output of ground fault sensing circuitry and other protection features. Power for the electric trip circuit shall be obtained from a control transformer connected from phase to phase on the line side of the switch. The electric trip coil shall be designed to operate at 55% of the rated voltage. Switches shall have an interrupting rating of 12 times continuous rating and have an operating mechanism that shall permit closure of the switch only after the opening mechanism has been charged, to assure that electrical tripping means shall immediately be in condition to open the switch.

D. Circuit Breakers

1. Electrical circuits shall be protected by molded case circuit breakers. Each pole shall provide inverse time delay and instantaneous circuit protection.

2. Circuit breakers shall be operated by a toggle type handle and shall have a quick-make, quick-break overcenter switching mechanism that is mechanically trip free from the handle so that the contacts cannot be held closed against short circuits and abnormal circuits. Tripping due to overload or short circuit shall be indicated by the handle automatically assuming a position midway between ON and OFF positions.

3. Breakers must be completely enclosed in a molded case. Non-interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be of the non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes.

4. All circuit breakers with frame sized 600 amps and larger shall have solid state trip units that are insensitive to changes in ambient temperature and a push-to-trip button to mechanically check the trip mechanism or for the use under emergency trip conditions. Interchangeable rating plugs shall establish the continuous current rating of each breaker. An interlock in the rating plug shall trip the breaker if an attempt is made to remove the plug with the breaker in the ON position. With the plug removed, it shall not be possible to close the breaker.

5. The solid state trip breakers shall provide long delay and magnetic tripping similar to thermal magnetic breakers. In addition, the magnetic trip shall include a short time delay permitting coordination and selective tripping with downstream devices. It shall be possible to check the breaker electrically and mechanically while in service without dismantling equipment and with minimum down time.

E. Ground Fault Protection

1. An adjustable ground fault protection system shall be provided as an integral part of the main circuit breaker or main fused switch, designated feeder breakers and fused switches.

2. The ground fault protection system shall consist of a current sensor enclosing all phase and neutral conductors of the circuits to be monitored, appropriate relaying equipment to provide the desired ground current sensitivity and time-current response characteristics, and equipped to function in conjunction with the other elements of the system.

3. The current sensor shall be of sufficient size to encircle the phase and neutral conductors of the circuit to be monitored. Current sensor output shall be coordinated with the required input to the delay. The current sensor shall have a ground fault current pick-up range of 200 to 1200 amperes. A test winding shall be included to simulate the flow of ground fault current through the sensor to test the operation of the ground fault protection system. The frame of the current sensor shall be constructed so that one leg can be opened to allow removal or installation around cable

without disturbing that cable.

4. The ground fault relay shall be solid state construction, except that a coil operated output relay may be provided to control 120 volt power to operate a fusible bolted pressure contact switch. The relay shall have an adjustable current sensitivity for ground fault pick-up currents from 200 amperes to 1200 amperes.

5. Provide a monitor panel on the switchboard, including a push-to-test button for the test circuit and a red ground fault indicator light to indicate the circuit interrupter has opened due to a ground fault condition. The unit shall operate on a 120 volt AC source.

6. Provide a pulsating audible horn that is activated when a ground fault condition occurs. Horn shall stop when ground fault protection system is reset. Horn shall operate during testing of ground fault protection system.

F. Short Circuit Current Rating

1. The switchboard as a complete unit shall be given a single short circuit current by the manufacturer of the rating as shown. Such a rating shall be established by actual test in accordance with U.L. specifications.

G. Provide ammeter with selector switch and voltmeter with selector switch and all associated internal wiring. Ammeter, voltmeter and associated selector switches shall be flush mounted on front of switchboard.

H. Main switchboards shall be as manufactured by General Electric, Square D, or Cutler-Hammer.

2.04 SINGLE PHASE PROTECTION

A. Provide Taylor Electronics Model #PND-3, 6, 9, 12 ADJ-REM LED's, or equal, single phase relay behind hinged panel in switchboard. Provide green and amber LED's on a plug in cable for mounting on face of switchboard. Provide snap on lenses and labels identifying the green LED as "SYSTEM NORMAL" and the amber LED as "SINGLE PHASE CONDITION".

B. Provide shunt trip coils on all main devices, operated by the phase failure relay.

C. Provide capacitive trip unit to guarantee relay and shunt trip operation during a single phase occurrence.

3.0 EXECUTION

3.01 INSTALLATION

A. Provide a typewritten directory under plastic for all panelboards with spares marked in pencil.

B. Provide all necessary hardware to level and secure the switchgear as required by the manufacturer's instructions. Make all electrical connections for supply and load circuits and leave in operating condition.

C. Clean enclosure of all switchgear of all foreign matter, including dust.

D. Remove all rust marks and repaint to leave switchgear in new condition.

3.02 STUDIES

A. Provide a complete short circuit and coordination study for the actual switchgear manufacturer provided from the service entrance to all end devices.

END OF SECTION

SECTION 16300

LIGHTING

1.0 GENERAL

1.01 DESCRIPTION

A. All work in this Section shall comply with the provisions of Section 16010.

B. Provide all lighting fixtures and lamps as specified herein and as shown.

C. All lamps shall be operating at the time of the final inspection and for a period of six (6) months after the final acceptance of the project by the Owner.

D. Confirm exact locations of all lighting fixtures by coordination with the Architects Reflected Ceiling Plans, Theatrical lighting consultant plans and mechanical equipment above or on the ceiling.

E. Confirm all ceiling types before ordering lighting fixtures.

F. Each lighting fixture shall have been tested and certified for proper operation by the fixture manufacturer for the type mounting and ceiling on/in, which it is installed.

2.0 PRODUCTS

2.01 LIGHTING FIXTURES

A. Each lighting fixture shall be as specified in the Lighting Fixture Schedule corresponding with its fixture type indication (letter).

B. Most lighting outlets are lettered or groups of outlets are indicated by a letter.

C. Each lighting fixture shall have a manufacturer's label affixed and shall comply with the requirements of all authorities having jurisdiction.

D. The lighting fixtures that are indicated by the letters shall be as indicated on the Lighting Fixture Schedule.

2.02 LAMPS

A. The type lamps shall be as specified for each lighting fixture in the lighting fixture schedule.

B. The lamp catalog number is the catalog number is generally for Sylvania Lighting and is given as a standard of the quality and performance required. Equal lamps by General Electric or Philips will be acceptable. When a lamp manufacturer's name is used along with the catalog number in the lighting fixture schedule, it is considered unequaled by any other lamp and shall not be substituted for. The lamp performance with energy conserving ballasts furnished under this Section shall be certified by a nationally recognized independent testing laboratory.

C. Fluorescent lamps shall be as specified in the Lighting Fixture Schedule.

D. Incandescent lamps shall be as specified in Lighting Fixture Schedule.

E. All incandescent lamps, except quartz tubes, shall be rated for 130 volt operation.

F. High Intensity Discharge (HID) lamps shall be as specified in the Lighting Fixture Schedule.

2.03 BALLASTS

A. Fluorescent ballast shall be electronic type manufactured by Motorola, Magnetek or Advance.

B. Ballast shall operate lamps at a frequency or 25 KHz or higher with less than 2% lamp flicker.

C. Ballast shall operate at an input voltage of 108 - 132 Vac (120V line) at an input frequency of 60 Hz. Light output shall remain constant for line voltage fluctuation of $\pm$ 5%.

D. Ballast shall comply with EMI and RFI limits set by the FCC (CFR 47 part 18) for non-residential applications and not interfere with normal electrical equipment.

E. Ballast shall withstand transients as specified by ANSI C.62.41 for location category A3 in the normal mode and location category A1 in the common mode.

F. Ballast shall meet applicable ANSI standards.

G. Ballast shall have a minimum power factor of 0.99.

H. Ballast shall not be potted or weigh more than 1.3 pounds.

I. Ballast shall have less than 10% Total Harmonic Distortion.

J. Ballast shall have less than 6% Third Harmonic Distortion.

K. Ballast height shall be less than or equal to 1.5 inches.

L. Ballast shall have a poke-in wiretrap connector.

M. Ballast shall meet sound rating "A".

N. Ballast must be Underwriters Laboratories (UL) listed Class P, Type 1 Outdoor.

O. Ballast shall provide normal rated lamp life as stated by lamp manufacturers.

P. Rapid start ballasts are series wired and shall maintain full cathode heat during operation.

Q. Rapid start ballast shall have less than a 1.5 Lamp Current Crest Factor (LCCF) and instant start ballasts have less than a 1.7 LCCF.

R. Instant start ballast shall have parallel lamp operation.

S. Ballast factor standard is .875$\pm$0.025 on all normal light output products.

T. Ballasts for "PL" fluorescent lamps shall be coordinated with lamps and 2-pin or 4-pin configuration ballasts shall be provided to match lamps. Manufacturer for "PL" fluorescent fixtures shall be Advance, Roberson, Lightolier or Lutron.

U. Ballasts for High Intensity Discharge (HID) lamps shall be Constant Wattage Autotransformer (CWA) type or equal type with minimum power factor of 0.9.

2.04 DIFFUSERS

A. Unless specified otherwise, all prismatic diffusers for fluorescent lighting fixtures shall be prismatic acrylic KSH K12 with a thickness of 0.125", measured from the back side to the peak of the prism.

B. All wraparound lenses shall be virgin acrylic, one-piece and injection molded.

2.05 EMERGENCY BATTERY LIGHTING

A. Lighting fixtures indicated on the drawings to be provided with an emergency battery ballast shall provide emergency lighting by using a standard fluorescent lamp or lamps and an emergency battery ballast. The ballast shall consist of a field replaceable high temperature, maintenance free nickel cadmium battery, charger and electronic circuitry contained in one metal case. Provide a solid state charging indicator light to monitor the charger and battery, double pole test switch and installation hardware. The battery ballast shall provide power to the fluorescent lamp upon failure of the normal supply to the fixture.

B. The test button and indicator light shall be integral in the fixture reflector and shall be positioned within or on the surface of the fixture so as to be accessible and identifiable.

C. Under normal mode the battery ballast shall keep the batteries at full charge. Upon loss of normal power the battery ballast shall operate the fluorescent lamp or lamps for 90 minutes.

D. Battery recharge time shall not exceed 16 hours to fully recharge and shall not exceed 225 milliamperes charging current

E. The lumen output of the lamp or lamps powered by battery unit shall be not less than 1,100 lumens initially for a four-foot fluorescent lamp.

F. The battery ballast shall meet or exceed all the requirements set forth in UL924 “Emergency Lighting and Power Equipment” and shall be UL listed for installation on top of or remote from the fixture. Emergency illumination shall meet or exceed the requirements set forth in the National Electric Code, Life Safety Code and UL 90-Minute Requirements.

2.06 LIGHT FIXTURE TRIM

A. Each recessed lighting fixture shall have a trim to match the type of ceiling (plaster, exposed grid, concealed spline, exposed panel, etc.) in which it is being installed, regardless of catalog number given. Coordinate with the Architect's reflected ceiling plan to provide the right trim for the type of ceiling the fixture is to be installed in.

B. Each lighting fixture recessed in a plastered ceiling of any type shall have a

plaster frame.

2.07 LIGHTING CONTROL

A. Provide a Photo/Time Control Center of the digital electronic type, which shall be suitable to operate mechanically held relays. The time switch shall function to prevent energization of lighting for preset periods each day. The time switch shall permit programming to allow 40 different ON-OFF settings for each day of the week per circuit with provision for omitting selected days. When permitted by the time switch, photocontrol shall operate the control center to energize whenever natural lighting falls below 25 footcandles.

B. The Control Center shall have a manual switching for each circuit to maintain lighting "ON" or "OFF" until manually returned to the "Automatic" position. The Control Center shall have a case cover to prevent external accessibility of the bypass switches.

C. The Control Center shall have one-year cumulative battery reserve.

D. The Control Center shall have a duty cycling feature allowing 1 to 99 ON or OFF inputs per circuit per day.

E. A Tork 5401 DPST shall be provided with the Control Center.

F. The Control Center shall have capability of controlling three (3) different types of circuits as described below:

Circuit A - Dusk (Photocell) On - Preset (Timeswitch) Off
Circuit B - Dusk (Photocell) On - Dawn (Photocell) Off
Circuit C - Preset (Timeswitch) On - Preset (Timeswitch) Off

G. The Time Control Center shall be Tork Model K800 (or Paragon DL series equal). Submit all devices and connection diagrams.

H. Provide all necessary contactors and/or to operate all circuits shown to be controlled. The relays/contactors shall have the number of poles required by the circuits controlled plus two (2) spare poles.

2.08 RECESSED INCANDESCENT FIXTURES

A. All recessed incandescent fixtures shall comply with Article 410-65, C of the N.E.C.

2.09 FLUORESCENT FIXTURES

A. All indoor fluorescent fixtures utilizing double ended lamps or that are supplied from multi-wire branch circuits, shall have a disconnecting means that complies with Article 410-73, G of the N.E.C.

3.0 EXECUTION

3.01 SUPPORT OF LIGHTING FIXTURES

A. All lighting shall be supported from the building structure. The fixtures shall be supported in a manner that will insure the fixture weight being equally distributed from each support and the fixture remaining in a level position.

B. Fluorescent fixtures installed recessed in a suspended ceiling system shall be supported from the building structure with two (2) 12 gauge wires on diagonal corners of the fixture. In addition, the fixture shall be clipped to members of the ceiling suspension system.

C. Fluorescent fixtures installed in or on any ceiling other than a suspended ceiling system specifically mentioned above shall be supported with concealed steel rods. Rods shall be 1/4" diameter minimum and shall be located where recommended by the fixture manufacturer. Provide a minimum of two (2) supports for each 4' or 8' fixture chassis. Supports shall be a maximum of 48" centers. For incandescent fixtures, steel hanging wire may be used by attaching the wire to the fixture mounting frame.

D. Pendant mounted incandescent fixtures shall be stem supported by a fixture stud mounted in the outlet box. Suspended fluorescent fixtures shall have mounting stems located as per the manufacturer's recommendations, but in no case shall have less than two (2) stems per chassis.

3.02 AIMING OF ADJUSTABLE LIGHT FIXTURES

A. All fixtures with lamp position, tilt, shutters, rotation, or other types of adjustments during the final inspection. Fixtures serving areas where day lighting is predominant will be adjusted after sunset.

3.03 LIGHTING FIXTURES IN MILLWORK

A. Special attention shall be given to lighting fixtures indicated to be mounted within, under, on or otherwise incorporated into millwork or cabinetry.

B. Refer to the Architectural drawings and details for specific dimensions. This coordination shall occur prior to ordering fixtures to assure fixtures will fit the space limitations of the millwork.

C. This requirement is intended to preclude incurring additions to the Contract due to fixtures being too small or too large for the space.

3.04 FINAL PREPARATION

A. All plastic covers shall be removed from fluorescent fixtures.

B. Clean all lens and reflectors from debris, fingerprints, dust, etc.

END OF SECTION

SECTION 16650

TRANSIENT SUPPRESSION

1.0 GENERAL

1.01 DESCRIPTION

A. All work in this Section shall comply with the provisions of Section 16010.

1.02 CODES AND REGULATIONS

A. The following codes and regulations shall govern the design of the transient suppression system:

1. Underwriters Laboratories UL 1449 Second Edition and 1283
2. Underwriters Laboratories UL 489 and UL 198
3. Underwriters Laboratories 248-1
4. National Electrical Manufacturers Association (NEMA LS1-1992 Guidelines)
5. ANSI/IEEE C62.41-1991 and C62.45-1992
6. National Fire Protection Association (NFPA 70 [NEC], 75, and 78)
7. ANSI/IEEE C62.1 and C62.11
8. Canadian Standards; (CUL)
9. Federal Information Processing Standards Publication 94 (FIPS PUB 94)

B. The unit shall be UL 1449 Second Edition Listed and CUL Approved as a Transient Voltage Surge Suppressor and UL 1283 listed as an Electromagnetic Interference Filter.

1.03 SUBMITTAL

A. The manufacturer shall furnish an equipment manual that details the installation, operation and maintenance instructions for the specified unit as part of the submittal.

B. Provide electrical and mechanical drawings that show unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit as part of the submittal.

C. Provide data showing UL 1449 Second Edition product listing, and certified documentation of applicable Location Category Testing in full compliance with NEMA LS 1-1992, paragraphs 2.2.10 and 3.10 as part of the submittal.

D. Provide data showing UL 1283 listing classification page and listing number(s).

E. Provide certified documentation of the unit's Single Pulse Surge Current Capacity Testing as part of the submittal demonstrating that the testing has been performed on a COMPLETE TVSS which includes all necessary fusing, integral disconnects, thermal fusing (when used), monitoring circuits, etc.

F. Provide certified documentation of the unit's Minimum Repetitive Surge Current Capacity Testing as part of the submittal demonstrating that the testing has been performed on a COMPLETE TVSS which includes all necessary fusing, integral disconnects, thermal fusing (when used), monitoring circuits, etc.

G. Short Circuit Current Rating (AIC): Provide 3rd party test data verifying that testing has been performed on a COMPLETE device.

1.04 MANUFACTURER'S

A. These specifications are based on Current Technology's TransGuard suppression filter system, Surge Suppression Incorporated suppression filter system or Liebert's LM Series TVSS. No substitutes will be accepted..

2.0 PRODUCTS

2.01 GENERAL

A. The unit shall be designed for parallel connection to the facility's wiring system. The suppression filter system shall be designed and manufactured in the USA by a qualified manufacturer of suppression filter system equipment. The qualified manufacturer shall have been engaged in the commercial design and manufacture of such products for a minimum of five (5) years.

B. Unit shall not require disconnection of power to customer equipment for testing and/or maintenance.

C. The primary suppression path shall not be to ground.

D. Scheduled parts replacement or preventive maintenance shall not be required.

E. High Performance Suppression System. The unit shall include an engineered solid-state high performance suppression system utilizing arrays of non-linear voltage dependent metal oxide varistors with similar operating characteristics. The suppression system components shall optimally share surge currents in a seamless, low-stress manner assuring maximum performance and proven reliability. The suppression system shall not utilize gas tubes, spark gaps, silicon avalanche diodes or other components which might short or crowbar the line, thus leading to interruption of normal power flow to or system upset of connected loads.

F. The Maximum Continuous Operating Voltage (MCOV) shall be greater than 115% of nominal voltage for all products. The suppression filter systems maximum continuous operating voltages shall be in compliance with test and evaluation procedures outlined in NEMA LS 1-1992, paragraphs 2.2.6 and 3.6.

G. The unit shall include an EMI/RFI noise filter and shall be UL 1283 listed as an Electromagnetic Interference Filter. The filter noise rejection and attenuation values shall be in compliance with test and evaluation procedures outlined in NEMA LS-1-1992, Paragraphs 2.2.11 and 3.11. The filter shall reduce fast rise-time, high frequency, error-producing transients and electrical line noise to harmless levels, thus eliminating disturbances, which may lead to electronic system upset. The filter shall provide minimum noise attenuation as follows:

1. 44dB @ 100KHz
2. 33dB @ 1MHz
3. 36dB @ 10MHz
4. 53dB @ 100MHz

H. All full magnitude transient current shall be conducted on low-impedance solid copper bussing. If printed circuit boards are utilized in surge current paths, no single trace shall be allowed to conduct more than the proportional current share of the connected TVSS component.

I. The unit shall include mechanical or compression lugs for each phase, neutral and ground connection. Lugs shall accommodate wire sizes up to 1/0 AWG. Wire size shall be not less than #2 AWG copper for phase, neutral and ground.

J. The unit shall include long-life, solid state, externally visible phase indicators that monitor the on-line status of each phase of the unit.

2.02 PHYSICAL REQUIREMENTS

A. Standard unit shall be supplied in a NEMA 12 metallic enclosure. Enclosure sizes and weights shall be clearly indicated in the product submittal.

B. Pilot lights indicating only internal component failure while continuing to allow the main power flow are NOT acceptable.

C. The device shall have a NEMA designed and certified safety interlocked integral disconnect switch located within the unit with an externally mounted metal manual operator. The switch shall disconnect all ungrounded circuit conductors from the distribution system to enable testing and maintenance without interruption to the facility's distribution system. The switch shall be rated for 600Vac. The TVSS device shall be UL1449 Second Edition listed with the integral disconnect switch and the UL1449 Second Edition Suppression Voltage Ratings shall be provided. The integral disconnect switch shall be capable of withstanding, without failure, the published maximum surge current magnitude without failure or damage to the switch.

2.03 ENVIRONMENT REQUIREMENTS

A. The unit shall not add appreciably to air conditioning load. Heat load shall not exceed 0.2kVA (0.682 BTU/hr.).

B. Average power consumption shall be less than 0.2kVA. Average power factor inefficiencies or harmonic distortion shall not result from use (THD - 0%).

C. The unit shall not generate any audible noise.

D. No appreciable magnetic fields shall be generated. Unit shall be capable of use in computer rooms without danger to data storage systems or devices.

E. Operating temperature range : -40 to +60 C (-40 to +140 F).

F. Storage temperature range: -40 to +85 C (-40 to +185 F).

G. Reliable operation with 5% to 95% non-condensing relative humidity.

H. Capable operation up to 18,000 feet above sea level.

2.04 ELECTRICAL REQUIREMENTS

A. The power conditioning and transient suppression capability shall be bi-directional and treat both positive and negative surge transients, yielding line control and short flicker ride-through. Unit shall be parallel connected and not limited by load current. Unit shall be unlimited in kVA capability.

B. The power handling capacity of the unit shall exceed 150,000A L-N, 150,000A L-G, 150,000A N-G, 150,000A L-L and 300,000A per phase as outlined in NEMA LS1-1992. Independent 3rd party test results must be provided to substantiate published values.

In compliance with NEMA LS-1-1992, Paragraphs 2.2.9 and 3.9, the suppression filter system shall be single pulse surge current tested in all modes at rated surge currents by an industry-recognized independent test laboratory. Single pulse surge current capacities of 250,000 amps or less are established by single-unit testing of all components within each mode. Due to present industry test equipment limitations, single pulse surge current capacities over 250,000 amps are established via testing of sub-assemblies within the device mode. The test shall include a UL1449 Second Edition surge defined as a 1.2 X 50 microsec, 6000V open circuit voltage waveform and an 8 X 20 microsec, 500A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an approximated 8 X 20 microsec waveform. To complete the test, another UL1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.

C. Per ANSI/IEEE C62.41-1991 and ANSI/IEEE C62.45-1992, all suppression filter systems shall be repetitive surge current capacity tested in every mode utilizing a 1.2 x 50 microsec, 20 KV open circuit voltage, 8 x 20 microsec, 10 KA short circuit current Category C3 bi-wave at one minute intervals without suffering either performance degradation or more than 10% deviation of clamping voltage at the specified surge current when subjected to not less than 10,000 impulses.

D. The UL 1449 certified suppression level after all duty/cycle and life tests shall have peak voltage ratings of 400 volts or less L-N, 400 volts or less L-G, 400 volts or less N-G and 700 volts or less L-L for units protecting 240 or 208 volt equipment and 700 volts or less L-N, 700 volts or less L-G, 700 volts or less N-G and 1500 volts or less L-L for units protecting 380 or 480 volt equipment.

E. Each suppression element shall be individually fused such that the failure of a single component or the operation of a single fuse element remains isolated and does not render the entire mode, or product, inoperable

Each MOV shall be individually fused. Every electrical current carrying conductor shall be fused such that every fault is isolated at the point of the fault or at the device level. Fusing shall be present in all modes, including Neutral-to-Ground. The device shall be capable of withstanding the full single pulse surge current capacity for every mode without the operation or failure of overcurrent / fault current protection or fuses. Per the requirements of NEC Article 285.6, the device shall bear the nameplate stating that the TVSS has a short circuit current rating (AIC Rating) that meets or exceeds the AIC rating of the distribution equipment to which the TVSS unit is applied. The service entrance TVSS shall have a 200kAIC short circuit rating.

F. The Maximum Continuous Operating Voltage (MCOV) shall be greater than 115% of nominal voltage. The suppression filter systems maximum continuous operating voltages shall be in compliance with test and evaluation procedures outlined in NEMA LS 1-1992, Paragraphs 2.2.6 and 3.6.

G. Operating frequency range shall be 47 to 63 Hertz.

H. All protected modes shall be as defined per NEMA LS-1-1992, Paragraph 2.2.7. Following IEEE Standard 1100-1992, section 9.11.2 recommendations, units shall provide protection in all modes. WYE configured systems shall provide ten (10) independent, discrete, dedicated modes of protection (Line-to-Neutral, Line-to-Ground, Line-to-Line and Neutral-to-Ground). DELTA configured systems shall provide six (6) modes of protection (Line-to-Line protection and Line-to-Ground). When a mode of protection is specified, the protective mode must be specifically included. Thus, Line-to-Neutral-to-Line is not an acceptable where Line-to-Line is specified.

I. The suppression filter system clamping voltages shall be in compliance with test and evaluation procedures outlined in NEMA LS-1-1992, Paragraphs 2.2.10 and 3.10. Maximum clamping voltages for units without and with an integral disconnect shall be as follows.

System Voltage	Mode	B3 Ringwave	6kV / 500A Comb. Wave	B3/C1 Comb. Wave	C3 Comb. Wave
120/240	L-N	325 / 350	325 / 325	425 / 425	600 / 725
120/208	L-G	400 / 425	325 / 325	425 / 425	625 / 725
	N-G	375 / 375	325 / 325	475 / 425	750 / 700
	L-L	350 / 450	625 / 600	775 / 825	950 / 1150
277/480	L-N	525 / 550	725 / 725	850 / 850	1100 / 1150
	L-G	825 / 875	725 / 750	800 / 850	1025 / 1150

	N-G	700 / 700	650 / 700	900 / 850	1200 / 1150
	L-L	675 / 725	1375 / 1350	1675 / 1650	1950 / 2100

2.05 TESTING REQUIREMENTS

A. Provide data confirming that the following tests have been performed. The data shall indicate the results of the tests conducted.

1. Each design configuration shall have a UL 1449 Second Edition Suppression Voltage Rating that has been tested and assigned by Underwriters Laboratories utilizing the following waveforms and procedure. The test shall be initiated with a surge of 6,000V / 500A, using wave shapes defined within ANSI/IEEE C62.41-1991 as a 1.2 X 50 microsecond open circuit voltage waveform and an 8 X 20 microsecond short circuit current waveform, to benchmark the unit's suppression voltage. The unit shall then be subjected to 10 positive polarity and 10 negative polarity 1.2 X 50 microsecond 6,000V open circuit voltage waveforms and an 8 X 20 microsecond 3,000A short circuit current waveforms. For comparison with the initial benchmark voltage reading, another ANSI/IEEE surge defined as 1.2 X 50 microsecond 6000V open circuit voltage waveform and an 8 X 20 microsecond 500A short circuit current waveform shall be applied. Deviation from initial to final clamping value may not exceed 10%.

2. In compliance with NEMA LS-1-1992, Paragraphs 2.2.9 and 3.9, each design configuration shall have the maximum single pulse surge current capacity per mode verified through testing. The test shall include a UL1449 Second Edition surge defined as a 1.2 X 50 microsecond 6000V open circuit voltage waveform and an 8 X 20 microsecond 500A short circuit current waveform to benchmark the unit's suppression voltage, followed by a single pulse surge of maximum rated surge current magnitude with an approximated 8 X 20 microsecond waveform. To complete the test, another UL1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage found from the two UL1449 surges does not vary by more than 10%.

3. Each design configuration shall have a repetitive surge current capacity rating which shall be verified through testing. The test shall include a UL1449 Second Edition surge defined as a 1.2 X 50 microsecond 6000V open circuit voltage waveform and an 8 X 20 microsecond 500A short circuit current waveform to benchmark the unit's suppression voltage, followed by a repetitive number of ANSI/IEEE C62.41-1991 Category C3 surges defined as a 1.2 X 50 microsecond 20,000V open circuit voltage waveform and an 8 X 20 microsecond 10,000A short circuit current

waveform. To complete the test, another UL1449 surge shall be applied to verify survival. Survival is achieved if the suppression voltage resulting from the two UL1449 surges do not vary by more than 10%. Proof of such testing shall be the test log generated by the surge generator.

4. Each design configuration shall be short circuit tested in accordance with the type of fusing utilized in the suppression path. Testing shall include application of a sustained overvoltage that causes the unit to enter a bolted fault condition. This bolted fault condition shall occur with the full rated AIC current of the fuse available. The fuse shall fail in a safe manner with no physical or structural damage to the unit and any failure shall be self-contained within the unit.

5. Each design configuration shall be surge tested with fusing in series to verify that a transient of maximum surge current capacity magnitude is fully suppressed without fuse failure, operation, or degradation.

6. The unit shall be factory tested at the applicable Maximum Continuous Operating Voltage to assure proper field operation.

7. Each unit shall be thoroughly factory tested before shipment. Testing of each unit shall include, but shall not be limited to, UL manufacturing and production-line tests, quality assurance checks, MCOV and clamping voltage verification tests.

2.06 STANDARD FEATURES

A. Unit Status Indicators The specified unit shall have an integral status circuit that monitors the operational status of all modes of protection, including Line to Neutral, Line to Ground, and Neutral to Ground. In the unlikely event the unit fails, the green LED will go out and the red LED will be lit. LED indication shall be provided internal and external to the product.

B. Dry Contacts for Remote Monitoring – TVSS must have electrically isolated Form C dry contacts, one normally open and one normally closed.

C. Undervoltage Detection – TVSS shall be equipped with 70% undervoltage detection.

D. Phase Loss Monitoring – TVSS shall be equipped with phase loss monitoring.

2.07 OPTIONAL FEATURES

A. Audible Alarm – The specified system shall be equipped with an audible alarm that is activated during a fault condition. In conjunction with alarm, an alarm

on/off switch shall be provided to silence the alarm, and an alarm push-to-test switch shall be provided to test the alarm's function. A visible LED will confirm whether alarm is on or disabled. Both switches shall be located on the unit's hinged front cover.

3.0 EXECUTION

3.01 INSTALLATION

A. The unit must be installed in accordance with the manufacturer's printed instruction to maintain warranty. All local and national codes must be observed.

B. Units shall be installed of the same voltage rating as the intended protected equipment, at no more than 2 feet from the panel to which it is connected with as few wire bends as possible. Provide overcurrent protection where required by the AHJ.

C. Start-Up Testing. Upon completion of installation, a factory-certified local service technician shall provide testing services per the manufacturers written requirements.

3.02 WARRANTY

A. Provide a Five Year Limited Warranty from date of acceptance of start up testing by the owner as indicated above.

B. The contractor shall provide a letter from the manufacturer's representative to the engineer, at the time of permanent power, certifying that all TVSS units have been tested and installed per the manufacturer's recommendation.

END OF SECTION

SECTION 16721

LIFE SAFETY SYSTEMS

1.0 GENERAL

1.01 DESCRIPTION

A. This section of the specification includes the furnishing, installation, connection and testing of the microprocessor controlled, intelligent reporting fire alarm equipment required to form a complete, operative, and coordinated system.

B. The fire alarm system shall comply with requirements of the NFPA Standard 72 for Protected Premises Signaling Systems and all local codes and regulations. The system shall be electrically supervised and monitor the integrity of all conductors.

C. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded onto the Signaling Line Circuits.

D. The system shall be an active/interrogative type system where each transponder is repetitively scanned, causing a signal to be transmitted to the local fire alarm control panel/node indicating that the transponder and its associated initiating device and notification appliance circuit wiring is functional. Loss of this signal at the local FACP shall result in a trouble indication on both the FACP display and at the network display, as specified hereinafter for the particular input.

E. The system shall be arranged such that not less than 20 percent additional transponders may be inserted into any network communication loop.

F. The FACP and peripheral devices shall be manufactured by Notifier, Edwards or Siemens.

G. The installing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site. To guide the final checkout and to ensure the systems integrity, the submitting company shall employ NICET Level IV minimum managers and engineers. Proof of NICET level training shall be included as part of submittal package and kept on site with personnel.

H. The installing company shall be UL listed for fire alarm installations. UL certificate shall accompany submittal package. The certification listing category shall be UUJJ and shall be indicated in the project submittal.

I. The Contractor shall make arrangements and pay all fees in connection with the testing of the Life Safety System. All system devices shall be tested for their correct operation, except non-restorable type heat detectors which shall be sample tested. All tests carried out shall meet the requirements of the local authority having jurisdiction.

J. The system shall have proper listing and/or approval from the following nationally recognized agencies:

1. Factory Mutual Systems
2. Underwriters Laboratories

1.02 SCOPE

A. A new intelligent reporting, microprocessor controlled fire detection system shall be installed in accordance to the project specifications and drawings.

B. Basic Performance

1. Each SLC loop shall be wired NFPA 72 Style 4 (Class B).

2. Initiation Device Circuits (IDC) shall be wired (NFPA Style B) as part of an addressable device connected by the SLC circuit.

3. Notification Appliance Circuits (NAC) shall be wired (NFPA Style Y) as part of an addressable device connected by the SLC circuit or a panel circuit.

4. NAC speaker circuits shall be arranged such that there is a minimum of one speaker circuit per 1,000 sq. ft. of the building or smoke zone, which ever is greater.

5. NAC speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.

C. Basic System Functional Operation

1. As part of the fire alarm; when a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

a. FACP will sound and display the alarm condition showing the device address, location, zone information, time/date, and device type.

b. The remote annunciator will sound and display the same information as shown on the FACP display unit.

c. Via system programming, the horn/bell outputs for all zones will activate and sound in temporal 3-3 pattern in synchronized fashion until silenced from FACP panel.

d. All strobes in areas with activated horn/bell outputs shall flash in a synchronized pattern until silenced from the FACP panel.

e. Automatic functions including, but not limited to: smoke evacuation, smoke door release and supply/return fan shutdown shall be activated via system programming as directed by codes and/or drawings.

f. Release all magnetically held smoke doors.

g. Provide signals to the mechanical controls including smoke dampers to shut down or reroute air-handling systems to prevent the recirculation of smoke.

i. Provide a DACT (Digital Alarm Communicator Transmitter) and a signal via DACT for connection to a central station or local municipal fire department (connection and leased line, if required, shall be provided by building owner).

j. Initiate a preprogrammed timing sequence.

k. Additionally, actuation of any smoke detector located in the air handling units and/or equipment rooms shall activate signals to the mechanical controls indicating the area of occurrence.

l. It shall be possible to silence the alarm signals by operating the signal silence switch. However, the activation of another zone shall repeat the entire alarm process, thus causing the signals to resound.

m. Silencing the alarm shall cause all speakers to silence. Firelights will continue to flash.

4. General Operation

A. Power failures, opens, grounds or any disarrangement of the system wiring or components shall be indicated by a visual and audible trouble signal. The audible trouble signal may be silenced; however, the trouble LED shall remain lit until the system has been returned to normal operating condition.

1.03 SUBMITTALS

A. General

1. Copies of all submittals shall be submitted to the Architect/Engineer for review prior to acceptance of system.

2. All references to manufacturer's model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.

3. The authority having jurisdiction shall be notified prior to installation of equipment and wiring. Complete information regarding the system including specifications, wiring diagrams, battery and power supply calculations, floor plans and graphics shall be submitted for approval.

4. If submittals, upon review by the Owner and/or the Owners Representative, are found not to conform with the performance, type and quality of products as well as all other requirements of these specifications; the Contractor shall be required to resubmit. The

Contractor shall be responsible for the Owner's extra expenses for subsequent review(s) of rejected submittals. Such extra fees shall be deducted from payments by the Owner to the Contractor. Approval of the submittals by the Owner shall, in no case, relieve the Contractor of the responsibility to meet the requirements of this specification.

B. Shop Drawings

1. Drawings shall include the following minimum requirements for submittal:

a. Point-to-point wiring/conduit layout for all devices on 1/8" scale plans.

b. Device placement showing all addresses and device ID.

c. All panel and equipment terminations.

d. All circuit voltage drop and current calculations spread sheets.

e. All battery calculation spreadsheets.

f. Legend reflecting device description, manufacturer, model number, and backbox requirement.

g. Wiring legend reflecting wire function, type, and recommended manufacturer's part number.

h. Full sequence of operations.

i. Power supply and amplifier calculations.

2. Specification data sheets on each individual system component.

C. Data Sheets

1. Submit simultaneously with the shop drawings, complete manufacturer's technical data sheets showing product description, listings, and specs.

2. Copies of NICET II and IV certifications.

3. Copy of company UL listing certificate.

1.04 APPLICABLE STANDARDS AND SPECIFICATIONS:

A. The specifications and standards listed below form a part of this specification. The system shall comply with the latest standards.

1. National Fire Protection Association (NFPA), 2000 Edition - USA:

No. 13	Sprinkler Systems
No. 13A	Halon 1301 Extinguishing Systems
No. 17	Dry Chemical Extinguishing Systems
No. 17A	Wet Chemical Extinguishing Systems
	Clean Agent Extinguishing Systems
No. 70	National Electrical Code
	Specifically Article 760
No. 72	1999 National Fire Alarm Code
No. 101	Life Safety Code

2. Standard Building Code, 2000 Edition

3. American National Standard A17.1-1980

4. Underwriter's Laboratories Fire Resistance Directory

5. Local and State Building Codes

6. ADA Public Law 101-336

7. All requirements of the Authority Having Jurisdiction (AHJ)

1.05 APPROVALS

A. The system shall have proper listing, approval and labeling from the following nationally recognized agencies:

FM	Factory Mutual Systems
UL	Underwriters Laboratories

1.06 SYSTEM FEATURES

A. The system shall include the following features as a minimum:

1. During an alarm condition, the LCD annunciator shall display the activated alarm until acknowledged. This shall allow determination of where the last alarm has taken place.

2. Ground fault detection in wiring on either plus or minus side.

3. Separate alarm and trouble shall be displayed on the LCD annunciator.

4. Resound feature.

5. "Dead Front" design control panel with all LED alarm trouble and power on indicators and all switches located behind a locked tempered glass door.

6. Solid state construction.

7. All alarm initiating circuit wiring, signal circuit wiring, speaker circuit wiring shall be supervised.

8. Automatic transfer to standby batteries upon power failure.

9. Lightning and surge protection.

2.0 PRODUCTS

2.01 Conduit and wire

A. All fire alarm wiring shall be installed in conduit. Conduit shall be installed as required by specification section 16100.

1. Wiring shall be in accordance with local, state and National codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system.

2. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

3. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes from the 120 volt normal power source or from a generator powered source if available.

2.02 MAIN FIRE ALARM CONTROL PANEL:

A. The FACP shall be completely microprocessor based.

B. System Capacity and General Operation:

1. Configure size of panel to operate number of SLC circuits in a fashion so that each circuit handles no greater than 70% load of capacity.

2. The fire alarm control panel shall include a full-featured operator interface and backlit 80-character Liquid Crystal Display (LCD).

3. The system shall be fully field programmable from the display panel. Panels requiring the use of external keyboards for programming and changes are not acceptable.

4. The FACP shall provide the **minimum** following features:

a. Drift compensation to extend detector accuracy over life.

b. Detector sensitivity test, per NFPA 72, Chpt 7.

c. Maintenance alert, to warn of excessive smoke detector dirt or dust accumulation.

d. Multiple sensitivity levels for alarm, selected by detector.

e. System status reports to display and printer. Provide printer.

f. Alarm verification, with verification counters.

g. Cross zoning with the capability of counting two detectors in alarm.

h. Walk test.

i. UL-1076 security monitor points.

j. Control-by-time with holiday schedules.

k. Day/night automatic adjustment of detector sensitivity.

l. Device blink control for sleeping areas.

m. Releasing capability.

n. Pre-Alarm.

o. Selectable sensitivity levels, three minimum.

p. History Storage, with a minimum of 400 events.

q. Point Enable/Disable.

r. Point Read (status and level of obscuration).

s. Output point for connection to any building EMS.

C. Signaling Line Circuits (SLC)

1. Each SLC interface shall provide power to communicate with 99 intelligent detectors (ionization, photoelectric or thermal) and 99 intelligent modules (monitor or control).

2. Each SLC circuit shall not exceed 70%, load capacity.

D. Serial Interface

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Electronic Data Processing (EDP) peripherals.

a. One serial port shall support a serial printer.

b. One serial port shall support a CRT/NRT device.

c. The system shall include an EIA-485 port for the serial. Connection of annunciators and remote LCD displays.

E. Field Charging Power Supply (FCPS): The FCPS is a device designed for use as either a remote 24-volt power supply or used to power Notification Appliances.

1. The FCPS shall offer up to 6.0 amps (4.0 amps continuous) of regulated 24-volt power. It shall include an integral charger designed to charge 7.0 amp hour batteries. Provide batteries to support 60-hour standby with ten minutes of alarm indication at the end of this period. Battery charger shall be capable of recharging all batteries to seventy percent capacity in twelve hours.

2. The Field Charging Power Supply shall have four outputs (two Style Y/Z and two style Y) shall be available for connection to the Notification devices.

3. Provide a 20-watt minimum spare capacity in each power supply for future tenant audible circuits. Locate in a junction box clearly labeled "tenant fire alarm audible circuits".

4. Provide Field Charging Power Supply (DC) to allow for future tenant build-out expansion of NAC devices. At no time shall there exceed 70% load capacity of any FCPS on any of the common levels.

5. Locate audible (where required) and visual power supplies adjacent to one another and in a location within each room approved by the engineer.

6. Provide battery capacity and amplifier capacity in the main fire control panel for addition of future tenant devices described above.

F. Provide and install ceiling mounted smoke detector within 5 horizontal feet of FACP.

2.03 SYSTEM COMPONENTS

A. Horns/Bells

1. All Horns/Bells shall be installed as shown on drawings and in accordance with NFPA-72 and local codes.

2. Horns in corridors and all public spaces shall produce a nominal sound output of 15dBA above average ambient noise levels with a minimum sound output of 15dBA.

3. Horns shall be UL-464 listed for fie evacuation and operate on 12 0r 24 voltage in a temporal 3-3 pattern.

4. Speakers shall be bone white in color.

5. Provide a unit cost to add horns. This unit cost shall be applied to additional horns that may be required at the request of the fire marshal during field inspections.

B. Speakers (theater only)

1. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.25 to 2.0 Watts.

2. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3m) when set at one watt as measured per UL Standard 1480.

3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.

4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.

5. Speakers shall be bone white in color.

6. Provide a unit cost to add speakers. This unit cost shall be applied to additional speakers that may be required at the request of the fire marshal during field inspections.

C. Strobe Lights

1. All Strobe Lights shall meet the requirements of the ADA, UL Standard 1971.

2. Strobe intensity and flash rate shall meet the requirements of UL 1971, ADA and NFPA 72.

3. Combination Horn/Strobe devices shall meet all above requirements as well as horn/bell requirements listed herein.

4. Strobe unit shall mount to a four inch square electrical outlet box. The strobe light shall have a white lens with red "FIRE" imprinted on it. When the unit is combination speaker/strobe, the speaker portion shall comply with the requirements stated in A. above.

5. All strobes shall have selectable output intensities from 15 to 110 cd. The intensity selected shall meet NFPA 72 requirements for the layout shown on the drawings.

6. Strobe spacing shall be as follows:

   a. Strobes shall be spaced a maximum of 100' apart in corridors and within 15' of the end of every corridor to comply with the requirements of NFPA 72.

   b. Strobes in open areas shall be provided to comply with NFPA 72.

   c. Provide strobes in public spaces such as restrooms, kitchens, breakrooms, cafeterias, conference rooms, training rooms and any other space where six or more people are likely to gather.

7. Provide a unit cost to add 5 strobes including required signal circuits. This unit cost shall be applied to additional strobes that may be required at the request of the fire marshal during field inspections.

D. Manual Fire Alarm Stations

1. Manual fire alarm stations shall be dual-action, non-coded, non-break glass type, equipped with key lock so that they may be tested without operating the handle.

2. Stations must be designed such that after an actual activation, they cannot be restored to normal except by key reset. Units shall be master keyed with control equipment.

3. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of 100 feet (30.5 m) front or side. This shall be achieved with the pull lever remaining at a right angle to the station body until reset.

4. The station body shall be constructed so that chips and scratches will not expose metal.

5. Manual fire alarm stations shall be located as required by NFPA 101 and the Standard Building Code.

E. Duct Smoke Detectors

1. Duct smoke detectors shall be addressable type with visual alarm and power indicators. Provide remote LED/test stations where duct detectors are mounted in non-visible areas such as above ceiling.

2. Each detector shall be installed upon the composite supply/return air ducts(s), with properly sized air sampling tubes where required. Provide smoke detectors in each return air path of any mechanical equipment that moves air in excess of 2000 CFM to meet the requirements of NFPA 72 and 90A. Provide smoke detectors in each supply and return air path of any mechanical equipment that moves air in excess of 15,000 CFM to meet the requirements of NFPA 72 and 90A. Confirm quantities of smoke detectors required for mechanical equipment with Division 15. Room detectors may be used to accomplish smoke detection in the supply/return air paths if the application permits.

3. Each duct detector shall be installed along with addressable control module as needed for fan shutdown and/or smoke control. Detectors zoned with other devices shall be capable of operating its control module even if all other devices on their circuit have gone into alarm.

4. Duct detectors shall be provided by this division, installed by the mechanical contractor and electrically connected to the fire alarm system by the electrical contractor.

F. Smoke Dampers

1. Smoke dampers shall be provided by division 15.

2. Provide a smoke detector at each smoke damper location to meet the requirements of NFPA 72. Confirm quantities and locations of smoke detectors required for smoke dampers with Division 15. Provide 120 volt power as required for operation of smoke dampers.

G. LCD Alphanumeric Display Remote Annunciator

1. The alphanumeric display annunciator shall be a supervised, backlit LCD display containing a minimum of eighty, (80) characters for alarm annunciation in clear English text. Annunciator shall be located as shown on the drawings or at the location selected by the local fire department.

2. The LCD annunciator shall display all alarm, supervisory, and trouble conditions from the FACP via the serial card.

H. Voice Evacuation System (theater only)

1. The Voice Evacuation System shall contain equipment required for all audio control, signaling and supervisory functions. This shall include:

a. Tone generators.

b. Digital voice units.

c. Microphone for manual paging/all call.

d. Speaker/phone circuit annunciation and control modules for manual activation of each individual speaker circuit and each individual microphone/annunciator circuit.

e. Integral Digital Message Generator with a capacity of up to 60 seconds. The Digital Message Generator shall be capable of primary and secondary messages (30 seconds each). These messages shall be field programmable without the use of additional equipment.

f. Built in alert tone generators with steady, slow whoop, high/low and chime tone field programmable.

g. Provide list of evacuation pre-recorded messages and pre-alert tones to owner before ordering for selection.

i. The Voice Control Panel shall have the ability to transmit up to 4 simultaneous evacuation message channels.

2. The one-way voice communications system shall be comprised of a local microphone, single channel audio controller/tone generator/digital message player and, if shown on the plans up to eight (8) remote microphone/annunciator panels.

3. Provide amplifiers. Size the amplifiers to accommodate each speaker being set at a one-watt tap with twenty watts reserve.

a. The audio amplifiers will provide audio power (@ 25 Volts RMS) for distribution to the speaker circuits.
b. The amplifier shall include audio input and amplified output supervision; back up input, and automatic switchover to back up (if primary amplifier should fail).
c. Amplifiers shall be available in 30, 100, and 120-watt versions.
d. Hardwired indicating appliance circuits (fire lights and speakers) shall be Style Y per NFPA 72.

2.04 SYSTEM COMPONENTS - ADDRESSABLE DEVICES

A. Addressable Devices - General

1. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the fire alarm control panel signaling line circuits.

2. Addressable photoelectric smoke and thermal detectors shall provide alarm and power/polling LEDs. LED(s) shall flash under normal conditions and LED(s) shall be placed into steady illumination by the control panel, indicating an alarm condition.

3. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system.

4. Detectors will operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.

5. All field wiring is to be terminated on the detector base, not on the sensor head. Addressing of detectors shall be via integral decade switches built into sensor. Devices requiring separate addressing means will not be accepted.

6. Any additional equipment required to program devices are not acceptable.

B. Intelligent Photoelectric Smoke Detector

1. The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

2. Provide photoelectric smoke detector heads with bases as required. Detectors shall be of the solid state photoelectric type utilizing a stable LED light source and a silicone photo diode as the receiving element to form a highly accurate means of smoke detection. Internal detector circuits shall be shielded against electrical interference and resistant to transients, noise and, RF interference. Detector shall be low profile, the complete unit including base shall not exceed 1.875 inches in depth. Detector shall have a dual purpose red LED that flashes continuously to show that the device is operating and, that comes on steady to show that the device is in alarm.

3. Nominal detector sensitivity shall be 1.4% per foot obscuration with a range of 1% to. 1.84%. Regardless of sensitivity settings, the detector's stability shall be unaffected by high air velocity. No radioactive materials shall be used.

4. Provide smoke detectors at stairwell doors, in telephone rooms, electrical rooms, mechanical rooms, adjacent to the fire alarm control panel, and pump rooms.

C. Linear Beam Smoke Detector

1. Each beam shall be comprised of a solid state infrared (IR) transmitter, photodiode receiver and microprocessor based control module. Should IR output be attenuated below the desired alarm obscuration level as a result of smoke interference an alarm will be annunciated. Total obscuration of the beam is annunciated as a beam blockage trouble signal. All wiring from the control module to the transmitter and receiver heads is supervised.

2. The projected beam smoke detector system shall have an operating range of 10M. (33 ft.) to 100M. (330 ft.) and be listed for spacing the beam 30 ft. from a wall and 60 ft. on center. The transmitter and receiver optical elements shall be adjustable +/- 90 degrees horizontally and +/- 30 degrees vertically. The sensitivity shall be field selectable from 7% to 50% obscuration.

D. Intelligent Thermal Detectors

1. Thermal detectors shall be intelligent addressable devices rated at 135 degrees Fahrenheit (58 degrees Celsius) and have a rate-of-rise element rated at 15 degrees F (9.4 degrees C) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

E. Addressable Dry Contact Monitor Module

1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device such as flow, tamper, release systems, future tenant devices, etc.) to one of the fire alarm control panel SLCs.

2. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.

3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.

4. Monitor module shall be provided for all sprinkler flow and tamper switches. Switches are furnished and installed by others and electrically connected to the fire alarm system by the electrical contractor. Verify quantities and locations and coordinate installation of devices required with fire protection shop drawings. Provide connections to devices per fire protection shop drawings.

F. Addressable Control Module:

1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contract relay. Each relay shall have a red LED mounted on its cover to indicate if that relay has been activated.

2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.

G. Door Holders

1. Provide door holders for wall mounting and for floor mounting. Door holders shall operate on twenty-four volt dc power and each holder shall not draw more than seventy milliamp of power. Coordinate quantities of door holders required with architect’s door schedule.

2.05 BATTERIES

A. The batteries shall be sealed, 12 volt nominal (two required).

B. The battery shall have sufficient capacity to power the fire alarm system for the time required in NFPA 72. This time shall be based on the type of system installed. At the end of this period the system shall be capable of operating all alarm notification appliances used for evacuation or to direct aid to the location of an emergency for 5 minutes upon a normal AC power failure.

3.0 EXECUTION

3.01 INSTALLATION

A. Provide all equipment, wiring, conduit and outlet boxes required for the erection of a complete and operating system in accordance with applicable local, state and national codes, the manufacturer's recommendations, these plans and specifications. Color code shall be used throughout.

B. Provide weatherproof devices with gasketed coverplates for exterior or damp locations.

3.02 TEST

A. The manufacturer's authorized representative shall provide supervision of final system panel connections, perform a complete functional test of the system and submit a written report to the contractor attesting to the proper operation of the system.

3.03 FINAL INSPECTION

A. Upon completion of the installation, the electrical contractor shall provide to the architect, with a copy to the manufacturer's representative, a signed written statement attesting that all system equipment was installed in accordance with these specifications and in accordance with wiring diagrams, instructions and directions provided to the contractor by the manufacturer.

3.04 INSTRUCTION

A. Instruction shall be provided as required for operating the system. Hands-on demonstrations of the operation of all system components shall be provided and shall include one session for a period of **8** hours. Additional time that may be required for end-user training will be at added cost to owner.

3.05 GUARANTEE

A. All equipment and wiring shall be guaranteed against defects in materials and workmanship for a two year period from the start up and beneficial use of the system. Warranty service for the equipment shall be provided by the manufacturer's factory trained representative during normal working hours, Monday through Friday excluding holidays. Emergency service provided at times other than as stipulated above shall be available from the same source at additional cost to the owner.

3.06 INSPECTIONS

A. Upon satisfactory completion of the system test, the manufacturer's representative shall present for the owner's consideration, a proposal to provide semi-annual inspection and tests of the system.

END OF SECTION

SECTION 16920

MOTOR CONTROLS AND WIRING

1.0 GENERAL

1.01 SCOPE

A. All work specified in this Section shall comply with the provisions of Section 16010.

B. All motors shall be provided under Division 15.

C. A motor starter shall be provided under this Section for each motor except for those specified in Division 15 to be furnished with integral starters. Motor starters shall be installed separately mounted adjacent to the motor served.

D. Motor power wiring is defined as those conductors between the energy source and the motor. This power wiring shall be terminated at the motor terminals.

E. All control wiring required for automatic starting and stopping of motors shall be provided under Division 15 unless specifically shown on the electrical drawings.

F. Power wiring shall be connected through all line voltage control devices such as firestats and thermostats.

2.0 PRODUCTS

2.01 MOTOR STARTERS

A. Starters for motors 1/3 horsepower or smaller shall be manual unless remote or automatic starting is required, in which case the starters shall be magnetic, full voltage, non-reversing, single-speed, unless otherwise indicated. All other starters shall be magnetic.

B. Each starter for a three-phase motor shall be furnished with three (3) overload relays sized for the full load running current of the motor actually provided. Provide an external "HAND-OFF-AUTO" selector switch with green "RUNNING" light. Provide a red pilot light to indicate motor "STOPPED". Each pilot light shall have a legend plate indicating reason for signal.

C. Each overload relay shall have a normally open alarm contact which will close only when actuated by an overload (not to be confused with N.O. or N.C. auxiliary contacts). These contacts shall be properly wired to their respective blue pilot light provided on the starter front cover and having a "TRIPPED" legend plate.

D. Individually mounted motor starters shall be in a NEMA Type 1 general purpose enclosure in unfinished areas and shall be flush mounted in all finished areas. All starters mounted in exterior areas shall have a NEMA 3R enclosure. Each starter shall have a laminated nameplate to indicate Division 15 unit number, function and circuit number.

E. A control power transformer shall be provided at each motor starter for connection to the controls provided under Division 15. The control power transformer shall be mounted inside the motor starter enclosure. All control transformers at 50 VA or greater shall have primary fusing. Coordinate all control equipments with Division 15 and equipment manufacturers.

F. All motor starters, push buttons and pilot lights shall be of the same manufacturer as the switchboard and shall be General Electric, Square D, Siemens I.T.E, Joslyn Clark Controls or Westinghouse.

2.02 COMBINATION STARTERS

A. Combination starters shall consist of a circuit breaker and a motor starter mounted in a common NEMA Type 1 general purpose enclosure.

B. The motor starter components shall be as specified in paragraph 2.01 for motor starters.

C. The circuit breaker component shall be a minimum 22,000 RMS interrupting capacity and shall be as required in Section 16200.

3.0 EXECUTION

3.01 INSTALLATION

A. Provide power wiring to and install all motor starters, unless integrally factory mounted on a piece of equipment.

B. Provide power wiring to all motors except packaged units that are prewired

between the starter and motor.

C. Where line voltage control devices are mounted at, on or inside a unit, such as aquastats, firestat for single phase devices, etc., the power wiring to the unit shall be connected through such a control device.

D. On final inspection, it shall be demonstrated to the Architect or his representative, that each overload relay control circuit is properly wired and functioning correctly by manually tripping each overload relay individually, one at a time. This inspection procedure shall not involve removing any wiring or disconnecting any current carrying parts.

END OF SECTION